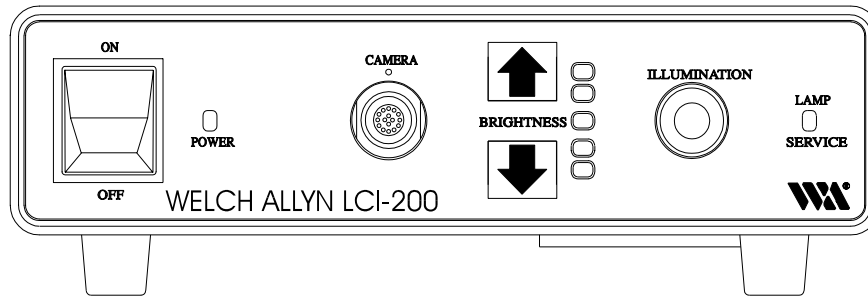
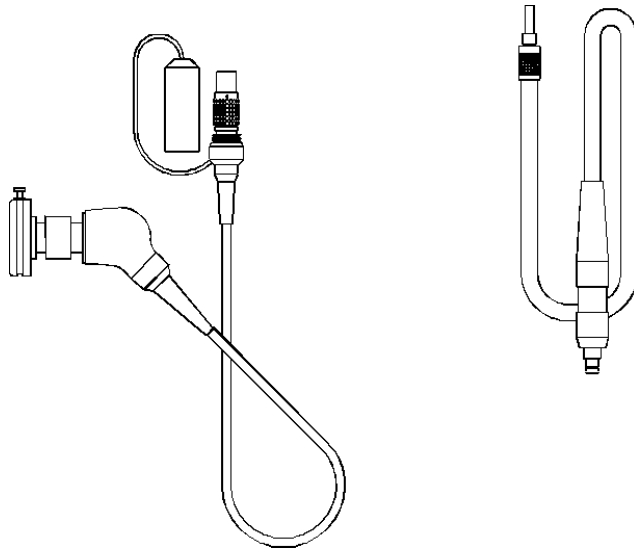


Service Manual



LCI-100/200 Illumination and Imaging System

Services LCI-100, LCI-200,
LCI-200CE and LCI-200S

To Service Personnel:

The information in this manual is subject to change without notice and should not be construed as a commitment by Welch Allyn, Inc.

Welch Allyn assumes no responsibility for any errors that may appear in this manual. If the product and/or its operation varies significantly from any description herein, please contact the Welch Allyn Imaging Products Group Product Service Department at 4619 Jordan Road, Skaneateles Falls, New York 13153, (315) 685-4108.

This product has been designed to provide a high degree of safety and reliability. However, we can not guarantee against the deterioration of components due to aging and normal wear.

All service and repairs must be performed by authorized Welch Allyn personnel or agents, using Welch Allyn replacement parts. Failure to do so will invalidate the product warranty.

Authorized service centers should refer to repair specification P02355 (Level 1) or P02113 (Level 2) for proper test and device history record requirements.

Please refer to the product warranty for specific coverage.



Welch Allyn, Inc.
Imaging Products Group
4619 Jordan Road
Skaneateles Falls, New York 13153
USA
(315) 685- 4108

Limited Warranty

Welch Allyn warrants the LCI-100/200, when new, to be free of defects in material and workmanship and to perform in accordance with manufacturer's specifications when subjected to normal use and service for a period of one year from the date of purchase from Welch Allyn or an authorized agent. Welch Allyn will either repair or replace any components found to be defective or at variance from manufacturer's specifications within this time at no cost to the customer. It shall be the purchaser's responsibility to return the instrument directly to their authorized distributor, agent or service representative.

This warranty does not cover the Hi-LUX lamp, breakage, or failure due to tampering, misuse, neglect, accidents, improper installation, modification, or shipping, or to improper maintenance, service, and cleaning procedures. This warranty is also void if the instrument is not used in accordance with manufacturer's recommendations or if repaired or serviced by other than Welch Allyn or an authorized agent. Purchase date determines warranty requirements. No other express or implied warranty is given.

For service assistance or questions regarding this warranty, please call Welch Allyn product service at (315) 685-4108.

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General Information

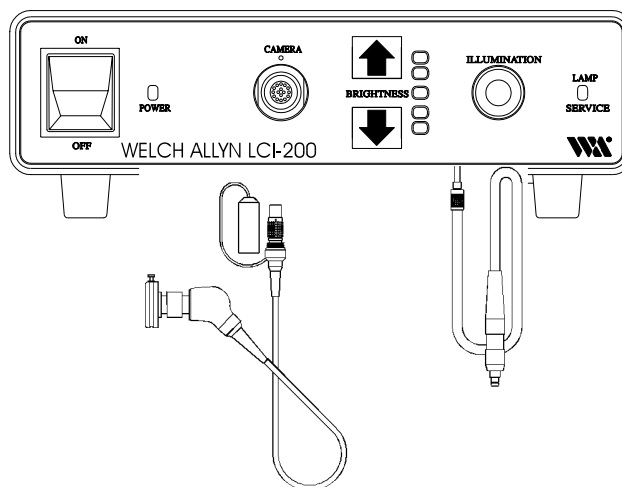
Introduction

The Welch Allyn LCI-100/200 Illumination and Imaging System is fundamentally different from any other illumination or video system. In this product, Welch Allyn has combined a compact light source with a very small remote video camera, which can be attached to nearly all rigid or flexible scopes. By engineering both the video and the illumination end of the product, Welch Allyn is able to produce a very small, highly efficient product. Furthermore, by combining the lighting and imaging in a single package, Welch Allyn has dramatically decreased the burden of system setup, and has eliminated the need for system white balance. The result is a compact, affordable lighting and video system for rigid and flexible endoscopic procedures.

Basic System Description

There are three major components to the LCI-100/200: the Power Box, the Camera Head Assembly, and the Fiber Optic Bundle. The centerpiece of the Power Box is a new Welch Allyn lamp which produces the same output as a high wattage Xenon arc lamp, but generates only a fraction of the heat. The Welch Allyn lamp produces a virtual "point source" of light, and is specifically designed to couple with a fiber optic bundle. The camera used in the LCI-100/200 is an advanced SONY one-half inch CCD camera. This camera uses the proprietary HyperHAD microlens architecture, whereby a microscopic light gathering lens is positioned over each pixel on the CCD, making the CCD extraordinarily sensitive to light. The SONY also operates in Auto-Shutter mode. The three major components of the LCI-100/200 are shown below.

Figure 1: Welch Allyn LCI-100/200 Illumination and Imaging System. Pictured are the Power Box, the Fiber Optic Bundle with Universal light post, and the Camera Head, with attached soaking cap and available C-Mount coupler.

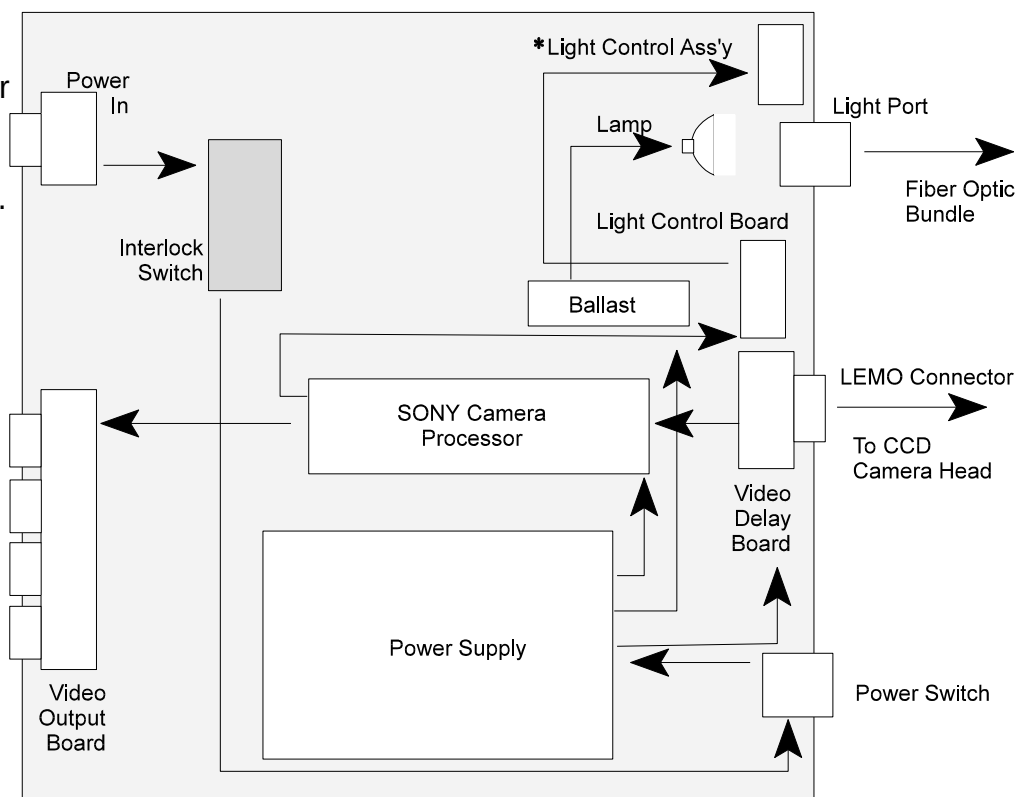


Section 1 General Information

NOTE: The LCI-200 Power Box adds a picture brightness control incorporating light control circuitry and a stepper motor. For purposes of this manual, an (*) will indicate sections not applicable to the LCI-100 Power Box. The Camera heads for both the LCI-100 and 200 are identical.

The main circuitry for the LCI-100/200 is found in the power box, and is illustrated below in a functional block diagram.

Figure 2: Functional Block Diagram of LCI-100/200 Power Box



Major Component Description: Power Box

The LCI-100/200 Power Box is driven by a universal switching power supply, which accept 100-240 VAC, 50/60 Hz without having to be adjusted. This power supply automatically senses line voltage, and makes the correct adjustments for any line input. This power supply is Medical Grade, and is approved for medical standards by UL, CSA, and TUV.

Power is supplied to two primary functions in the Power Box: lighting and video processing. For illumination, a ballast is used to ignite and operate the lamp. The lamp used in the LCI-100/200 is a proprietary Welch Allyn miniature arc lamp, which provides superior illumination in a package only a fraction of the size of typical endoscopic light sources. Both the lamp and the ballast are manufactured by Welch Allyn. Power is also supplied to a SONY Camera, which used to process the video image. A video delay board accounts for the distance between the CCD and the camera processor. A light control board also operates inside the Power Box; this board analyzes the video signal, and modulates the amount of light through a mechanical light control assembly.

Section 1 General Information

A video output board provides two S-video and two composite video signal outputs. All of these components are diagrammed in the functional diagram on page 7; front and rear panel diagrams are shown below.

Figure 3: Rear Panel

1. AC Power Input
2. Fan Grill
3. 2 Composite Video Outputs, BNC Type
4. 2 S-Video Outputs
5. Potential Equalization Stud
6. Fuse Drawer

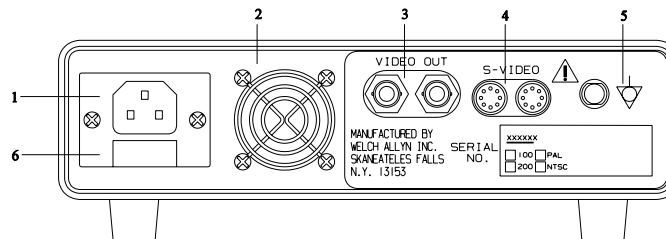
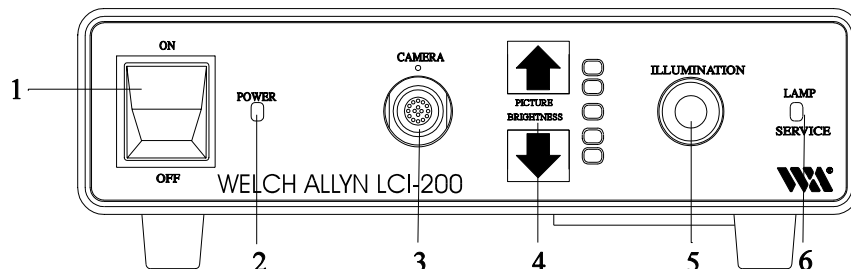


Figure 4: Front Panel

1. Power Switch
2. Power Indicator
3. LEMO Connector
4. Picture Brightness Control
5. Light Port
6. Lamp Service Light



Major Component Description: Camera Head

The camera head assembly is made of a SONY 1/2 inch CCD packaged into a handpiece, a ten foot video cable with LEMO connector, and a soaking cap. A C-Mount optical coupler is a separate component which screws onto the camera head. The CCD used incorporates the new HyperHAD architecture, making the chip extremely sensitive to light.

Major Component Description: Fiber Optic Bundle

A 5mm diameter fiber optic bundle is an accessory in the LCI-100/200 product. This bundle uses an ACMI standard fitting on the Power Box end, and has a universal light post on the scope end. The bundle accepts three scope adapters (Wolf, Storz and ACMI) that can be fitted on to the universal post. Other adapters are available upon request.

Specifications

The specifications for the Welch Allyn LCI-100/200 are as follows:

Power Supply

100-240 VAC, 50-60 Hz, automatic switching
Power consumption 200 watts maximum
Leakage current less than 35 microamps

Dimensions

9.25 inches wide x 8.125 inches deep by 2.375 inches high
Less than 5 pounds

Video Outputs

2 Y/C S-Video Type
2 Composite BNC type, 1.0 V p-p 75 ohms

Illumination System

Proprietary Welch Allyn Arc Lamp
Color temperature 5500 degrees K
Lamp voltage 60 Volts , 24 watts
Lamp life averages 350 hours, based on 60 minute on/15 minute
off duty cycle

Shutter System

* Mechanical: Motor driven shutter
Electrical: Infinitely variable, no-step autoshutter

Image Device

1/2" SONY Interline Transfer CCD with HyperHAD
768 x 493 Total Pixels (NTSC)
756 x 581 Total Pixels (PAL)
Complementary Color Mosaic Filter
Cable Length 10 feet

Scanning System

2:1 Interlaced, 525 lines, 30 frames/sec (NTSC)
2:1 Interlaced, 625 lines, 25 frames/sec (PAL)

Horizontal Resolution

Greater than 470 lines

Fiber Optic Bundle

Power Box Side Interface: ACMI
Scope Side Interface: Universal
7.5 feet

Approvals

UL-544, IEC-601-1, IEC-601-2

Equipment Classification

Power Box - Class I, Type B
Camera Head - IPX7, Type B
When used with Type F endoscope, complete system is classified
Type BF

Fuses

250V, 2.0 amps, 5 x 20mm, Fast-Blo

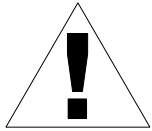
USA Patents

5, 144,201; 5,083, 059; 5,138,228; 5,117, 154; other pending

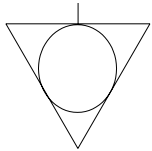
Environmental

Storage -20°C to 60°C (-4°F to 140°F)
Operating - 0°C to 40°C (32°F to 104°F)

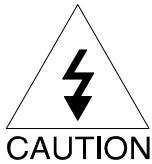
System Symbol Descriptions



Attention. Read Service Manual for Warnings, Precautions, and Instructions for Use.



Potential Equalization Stud



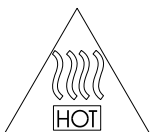
Dangerous Voltage



TYPE B Equipment



Warning. Risk of Fire. Replace Fuses as Marked.



Intense heat may be emitted. Use extreme caution when handling.



ESD Warning. Many of the electronic devices in this equipment are static sensitive.

Service

Intent of Manual

The purpose of this manual is to provide Welch Allyn Inc. authorized service representatives with systematic guidelines for preventative maintenance, problem identification, and service of the LCI-100/200 Illumination and Imaging System. We have included the theory of operation, schematic diagrams, simplified drawings, service tips and procedures, to assist a trained service representative with board level repairs. Should you encounter problems that are beyond the scope of this manual, please contact Welch Allyn's Imaging Products Group Service Department for assistance.

Required Tools for Service

You will need only standard electronic and mechanical tools to perform board level repairs. Test equipment must be in good condition and calibrated regularly. The following commercially available tools are required for the repairs included in this manual.

Antistatic Workstation

DVMS Milli-ohmmeter Fluke Model 77 or equivalent

Oscilloscope (TV triggering)

Vectorscope Tektronics 1745, Tektronics WVR500, or equivalent
(for color-related video adjustments only)

Calibrated, NTSC or PAL video monitor, SONY PVM 1350 or
equivalent preferably Medical Grade.

Associated Research 411 AI AC Hipot Jr or Equivalent

Hipot Shorting Plug (WT-5736)

40W Soldering Iron

Welch Allyn Tools: These tools can be purchased from Welch Allyn (Welch Allyn Tool Number appears in parentheses).

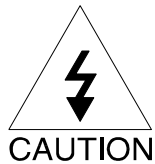
Leakage Tester (WT-5515) or Equivalent

LEMO Connector HyPot Test Tool (WT-5756)

Front Panel LEMO Removal Tool (WT-1962)

Final Test Spec P02113

Words of Caution



High Voltage

Use caution when servicing an LCI series system. When servicing the unit, potentially dangerous high voltage levels are exposed. Disconnect the power cord whenever possible to avoid electric shock.



Static Electricity (ESD)

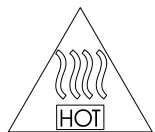
Adhere to standard ESD practices at all times when servicing this equipment. Many of the electronic devices in this equipment are static sensitive, and may suffer catastrophic or latent failure if handled improperly.

Fiber Optics

If it is necessary to handle exposed fiber optic glass, use extreme caution. Unnoticed broken or loose fibers can get in your fingers, hair, and clothing. Avoid contact with eyes or face during and directly after fiber optic contact. Wash hands thoroughly after fiber optic contact.

Finished Parts

Handle all finished parts with care. The finish can be easily scratched or damaged from poor or improper handling.



Heat

Lamps, power supplies, and heat sinks may emit extreme amounts of heat during and after operation. approach and handle these and other potentially hot components with caution.

Performance Checks

The following performance checks will help you (1) determine whether or not the LCI-100/200 is operating correctly, and (2) isolate a problem, if there is one.

System Set Up

Make sure that the LCI-100/200 is connected as follows:

1. Be sure that power is being provided by the wall outlet. Plug the power cord into the back of the LCI-100/200, and plug in the video monitor. **Do not turn the power on.**
2. Plug the fiber optic bundle into the light port on the Power Box, and plug the Camera Head cable into the Power Box. **The Camera Head must be plugged in before the Power Box is turned "ON".** The Camera Head should have a C-Mount optical coupler attached. Attach the Fiber Optic Bundle and Camera Head to an endoscope (preferably a 10mm diameter laparoscope).
3. Be sure that the video monitor is functioning properly. This may involve connecting a different camera or VCR through the same composite S-video connector.
4. Connect both the S-video and the composite video cables between the LCI-100/200 and the tested video monitor.
5. Turn POWER switch on both the video monitor and the LCI-100/200 to "ON". After 5-10 seconds of warming up, the lamps will produce a steady, white light, which should come through the tip of the laparoscope. The Power LED should be illuminated on the Power Box, and the Lamp Service LED should not be illuminated. The middle LED in the Picture Brightness panel should be illuminated, and the user should be able to move the LED up or down. A high quality video image should be displayed on the monitor. Do not repeatedly turn the LCI-100/200 On and Off; the lamp needs 10- 15 seconds to "cool down" between uses.

If these conditions do not occur, see the troubleshooting section.

Testing the CCD/Video Connections

1. Remove the Camera Head (with Coupler) from the endoscope.
2. Cover the Camera Head with your hand, so that no light gets into CCD.
3. Inspect video monitor. There should be no electronic noise displayed.
4. Wiggle the LEMO connector, and inspect the monitor. There should be no electronic noise.
5. Wiggle the strain relief near the Camera Head and inspect the monitor. There should be no electronic noise.

NOTE: Early units (prior to serial number 100253) may exhibit minor amounts of electronic noise when camera head is covered. This is normal for early units.

Testing the Light Control Functions

1. Reattach the Camera Head (with coupler) to the endoscope. The fiber optic light guide should also be attached.
2. Place your hand 12 inches away from the endoscope tip. Quickly move our hand to 1/2 inch away from the endoscope and observe the monitor. The LCI-100/200 should take about one second to adjust from a bright scene to a normal scene. Repeat the procedure several times.
3. Press the Picture Brightness control to its lowest position, and inspect the monitor. The picture should be darker. Repeat the hand test above. The LCI-100/200 should still be able to adjust to different lighting conditions, although the brightness of the video image will be lower.
4. Press the Picture Brightness control to the second highest position, and inspect the monitor. The picture should appear bright. Repeat the hand test from Step 2. The LCI-100/200 should still be able to adjust to different lighting conditions, although the brightness of the video image will be higher.
5. Press the Picture Brightness control to the highest position. In this position, the mechanical shutter opens up completely, and all light control functions are performed electronically by the SONY autoshutter. Repeat the hand test from Step 2; the electronic autoshutter should take about 2 seconds to adjust from a 12 inch distance to a 1/2 inch distance. This is normal.
6. Return the Picture Brightness control to the middle setting.

*** Testing the Optical Sensor and Shutter**

1. While the LCI-100/200 is still powered "ON" remove the fiber optic bundle. the light coming out of the LCI unit should fade. The Picture Brightness control switches should be de-activated.
2. Plug the fiber optic bundle back into the LCI-100/200. The sensor should be activated and light should come out the tip of the fiber optic bundle.

Examining the Fiber Optic Bundle

All fiber optic bundles degrade over time. As fibers break, less light is conducted from the lamp to the scope being used. As a result, a worn fiber optic bundle can cause the video picture to appear too dark. Welch Allyn recommends that a new fiber optic bundle be purchased every 6- 12 months (which is about the same cycle as the lamp).

1. Remove the fiber optic bundle from the LCI-100/200.
2. Hold one tip of the bundle up to an overhead light, and examine the other tip of the bundle. If more than 20% of the individual fibers appear broken (i.e.: more than 20% of the fiber bundle is dark), then the bundle should be replaced.
3. Replace only with Welch Allyn Part Number VA295.

Calibrations

Routine electrical calibration of the LCI-100/200 is not required. All electrical parameters are factory set.

Routine calibration of video monitors is highly recommended. Refer to your video monitor service manual for instructions on calibration and video alignment.

Problem Solving

Troubleshooting

Experience shows that many service calls are due to improper operator technique and poor connections. Before taking apart the LCI system, make sure that setup errors are not causing the problem. **When checking voltages or signals, be sure to verify signal through the harness wires, connectors, and on the circuit board.** Reference numbers in parentheses, such as (A5), refer to the Interconnect Diagram located in APPENDIX A.

Symptom	Possible Cause	Procedure
No image, power LED not illuminated, lamp not illuminated	Power line cord damaged or disconnected	Connect, repair, or replace as necessary
	Power is not turned to "ON"	Turn power on
	Interlock switch disengaged	Verify that lamp replacement door is firmly and properly secured in place.
	AC line fuses F1 and F2 open	Replace fuses F1 and F2 on Rear Panel Appliance Inlet (J100).
	Open circuit connection	Verify AC input through unit to the Power Supply (A1).
	Power supply circuit defective	<i>If Power Supply (A1) fuse F1 not blowing:</i> Check for: 110-240 VAC in at J1 +15V output at J2 <i>If F1 fuse is blown:</i> Disconnect P2 and J2 on the power supply. Replace F1 fuse. Reapply power. Verify output voltages at J2. If voltage is not present or if fuse blows again, replace power supply.
	Other circuits loading down power supply	Disconnect and isolate video output board (A5) by removing connector P8. Disconnect and isolate ballast board (A4) by removing connector P2A.

Section 3 Problem Solving

Symptom	Possible Cause	Procedure
Lamp does not illuminate, even with new lamps.	Defective ballast	Check for +15V across pins 1 and 2 of connector P2A on ballast (A4). Using a known good lamp or a 151 ohm/50 watt resistor, measure approximately 60V DC at P1 and P2 pins of ballast output. Measure DC voltage across P1 and P2 without lamp. Load to be approximately 9V. If P1 and P2 measure 0 volts, replace Ballast.
	Defective lamp connector	Check continuity and replace if defective.
	Bad test lamp	Substitute 151 ohm/50 watt resistor for lamp if necessary and verify 60 VDC across P1/2.
	Lamp is near end of life.	Replace lamp.
Image good, lamp illuminated, lamp service LED is ON	Lamp Service LED board (A3) shorted out	Using ohmmeter, verify that pin 2 on J1 of Lamp Service Board (A3) is not shorted to front panel chassis. Remove A3, clip long lead components or replace board.
	Ballast defective	Check voltage on pin 2 at J1 of Ballast Board (A4). If should measurement 10.5 volts with Lamp Service LED off; 0 volts with Lamp Service LED on. Replace ballast if defective.

Section 3 Problem Solving

Symptom	Possible Cause	Procedure
No image, Power LED is illuminated, lamp is illuminated	Improper system setup	See Operating Manual
	Camera Head was not plugged in when box is powered on	Connecting the Camera Head to the Power Box while the power is on may shut down the camera. This is caused by an overload protection circuit within the camera system.
	Defective Camera Head	Use test camera head and check for video image. Please note that, since the Camera Heads and Power Boxes are matched, the quality of the video image may be impaired. Replace Camera Head and Combined Camera Module/Front Panel Board Assembly (A7/A6).
	Defective Camera Model (A7)/Front Panel Board (A6) combined assembly	Check for +12V on pins 5 and 7 on J8 at Video Output Board (A5). If incorrect, troubleshoot Video Output Board. Verify +5V at pin 13 of LEMO Connector J2, per FIGURE 9 on page 41. Check for video signals at pins 11 and 13 of P8 on Video Output Board (A5). If video signal is present, troubleshoot output board. If not, continue this section. Verify +12V at J3 of Front Panel Board (A6). Ensure that flex circuit is connected to J1. Lightly tap the flex circuit with a hand tool while watching the video monitor. Check monitor for intermittent image. Verify +12V, -12V and video signal input and output on Output Board (A5). Replace Camera Head and Combined Camera Module/Front Panel Board Assembly (A7/A6).

Section 3 Problem Solving

Symptom	Possible Cause	Procedure
Picture failure (random or intermittent) after unit warms up, Power LED and lamp both illuminated.	Poor video connections	Check connectors and wire integrity. Follow same procedure as No Video Image, Power LED and Lamp Illuminated.
	Damaged Camera Head/Cable	Visually inspect entire cable. Flex wire cable while observing cable to check for broken wires or connections. Vibrate probe while observing video picture.
	Defective Output Board	Verify +15V, +12V and video signal input and output on Output Board (A5).
	Intermittent Power Supply	See Power Supply Troubleshooting section.
	Defective Front Panel Board/Camera Interface Board	See appropriate causes in previous section.
	Intermittent Interconnect	Check connectors between circuit boards for intermittent connections.

Section 3 *Problem Solving*

Symptom	Possible Cause	Procedure
*Too little, too much, or no light control	Picture Brightness control on Power Box set at top position Defective Camera Module Defective Motor Defective Light Control Board Defective or misaligned light sensor (A10).	Change brightness control to any of the lower settings Increase target distance Verify signals at J1 of Light Control Board (A9). Verify signals at Motor (M2). Assure motor rotation with and without power. Verify stepper motor and sensor outputs J2 and J3 on Light Control Board (A9). Verify signal at J3 on Light Sensor Board (A10). See sensor repair section
*Picture Oscillation (light control)	Picture Brightness control on Power Box set at top position Defective Camera Module Defective Light Control Board Defective or misaligned Light Sensor A10.	Change brightness control to any of the lower settings. Increase target distance. Verify signals at J1 of Light Control Board (A9). Verify stepper motor and sensor outputs J2 and J3 on Light Control Board (A9). Verify signal at J3 on Light Sensor Board (A10). See sensor repair section and Light Control Board theory of operations.

Section 3 Problem Solving

Symptom	Possible Cause	Procedure
*Light vane oscillates when fiber bundle is removed from Power Box.	Misaligned sensor	See repair section, Misaligned sensor.
*Light vane does not close when fiber bundle is removed from box.	Defective or misaligned sensor.	See repair section, Misaligned sensor.
Picture aberration (loss of color at close or medium views, but satisfactory colors at distant views), or video smearing on edge or corner of image.	Defective or damaged flex circuit inside camera head assembly.	Replace Camera Head and Combined Camera Module/Front Panel Board Assembly (A7/A6).
White dots visible on video monitor, especially in dark scenes or distant views.	Insufficient ground.	Solder a jumper wire at video output board (A5), from brass mounting block solder joint, to SVHS connector J4 solder joint.
Dark horizontal bands rolling across the monitor.	Insufficient ground at Camera Module (A7) caused by loose hardware or excess paint on camera body.	Tighten hardware, and remove excess paint on bottom side of Camera Module (A7) body.
Probe unable to withstand 8 psi pressure test.	Leak at LEMO cap.	Replace LEMO cap, and retest.
	Window retainer not secure.	Tighten window on Camera Head with Window Removal Tool WT-1809.
*Light control motor makes obtrusive noise but functions properly.	Chatter on motor shaft. NOTE: Motor chatter does not affect motor performance.	Place finger on motor shaft. If this quiets the motor, then a clip applied to the motor shaft may be effective in decreasing noise. This clip can be purchased from Welch Allyn.

Connector Pinouts

Use the following tables during troubleshooting to help locate signals.

	Connector	Pin	Name	Description
Power Supply Board (A1)	J1	1-2	LINE	AC input power
		3	NEUT	Neutral
	J2	1-3	+15V	+15V supply out
		4-6	GND	ground
	J3	n/c		

	Connector	Pin	Name	Description
Video Output Driver Board (A5)	J8	1	+15V	+15V in from Power Supply
		2	GND	ground
		3	+12V	+12V out to Front Panel Board
		4	GND	ground
		5	+12V	+12V out to Camera Module
		6	GND	ground
		7	+12V	+12V out to Camera Module
		8	GND	ground
		9	_12V	_12V out to fan
		10	GND	ground
		11	Y-VID	Y-video signal in
		12	Y-GND	ground
		13	C-VID	C-video signal in
		14	C-GND	ground
	J6-J7	1	CVO	composite video out
		2	GND	ground
	J4-J5	1-2	GND	ground
		3	Y-VID	Y-video signal out
		4	C-VID	C-video signal out

Section 3 *Problem Solving*

SONY Camera Module Board Set (A7)

Connector	Pin	Name	Description
J2	1	GND IN	ground in from (A5)
	2	+12 IN	+12V in from (A5)
	3	Y-GND	Y-video ground out to (A5)
	4	Y-VID	Y-video signal out to (A5)
	5-7	unused	
	8	C-GND	C-video ground out to (A5)
	9	C-VID	C-video signal out to (A5)
	10	GND	ground
	11	RGB	RGB signal detector
	12	unused	

*** Front Panel Board (A6)**

Connector	Pin	Name	Description
J1 Flex circuit to Camera Module Board Set (A7)	1	V4	vertical clock
	2	V3	vertical clock
	3	V2	vertical clock
	4	VSUB	substrate (overflow drain)
	5	V1	vertical clock
	6	VL	protective transistor bias
	7	+15	+15V supply
	8	GND	ground
	9	VID	CCD video
	10	GND	ground
	11	GND	ground
	12	VSS	output amp source (ground)
	13	GND	ground
	14	RG1	reset clock
	15	NC	
	16	H1	horizontal clock
	17	H2	horizontal clock
J3	1	+12	+12V in from (A5)
	2	GND	ground
	3	GND	ground
	4	+12	+12V in from (A5)

(A6) is continued on the next page

Section 3 *Problem Solving*

***Front Panel Board (A6)**

Connector	Pin	Name	Description
J2	1	V4	vertical clock in
	2	V3	vertical clock in
	3	V2	vertical clock in
	4	VSUB	substrate (overflow drain)
	5	V1	vertical clock in
	6	VL	protective transistor bias
	7	GND	ground
	8	+15V	+15V
	9	VID	CCD video
	10	VSS	output amp source (ground)
	11	RG	reset clock
	12	H	horizontal clock
	13	+5V	+5V
	14	GND	ground

***Light Control Board (A9)**

Connector	Pin	Name	Description
J1	1	+12	+12V from (A6)
	2	GND	ground
	3	+12	+12V to (A2)
	4	GND	ground
	5	Y-VID	Y-video signal from (A7)
	6	GND	ground
J2 to Motor (M2)	1	STEP1	control functions to M2 motor
	2	STEP2	control functions to M2 motor
	3	STEP3	control functions to M2 motor
	4	STEP4	control functions to M2 motor
J3	1	SENSE	signal from Light Sensor (A10)
	2	GND	ground

Section 3 *Problem Solving***Ballast (A4)**

Connector	Pin	Name	Description
J1	1	+V	
	2	SERVICE	
J2	1	+15V	+15V from Power Supply (A1)
		<i>note: Inductor L between (A1) and (A4)</i>	
	2	GND	ground

Disassembly and Repair

About This Section

This section describes how to remove and replace major sub assemblies of the LCI-100/200 Power Box. To find an assembly, refer to "Parts List & Exploded View" on Page 28.

Removal and Replacement Warnings

Before proceeding, be aware of the following:



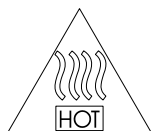
High Voltage

Use caution when servicing an LCI series system. When servicing the unit, potentially dangerous voltage levels are exposed. Disconnect the power cord whenever possible to avoid electric shock.



Static Electricity (ESD)

Adhere to standard ESD practices at all times when servicing this equipment. Many of these electronic devices in this equipment are static sensitive, and may suffer catastrophic or latent failure if handled improperly.



Heat

Lamps, power supplies, and heat sinks may emit extreme amounts of heat during and after operation. Approach and handle these and other potentially hot components with caution.

When removing an assembly, pay attention to the wire and connector positions, to facilitate prompt reassembly.

Exploded View Diagrams

In the following section, there are five exploded view drawings, with breakdown of part numbers and descriptions. Refer to these drawings when following the disassembly and repair procedures, which begin on page 4-6.

FIGURE 5: FRONT PANEL PARTS LIST

BUBBLE NUMBER	DESCRIPTION	PART NUMBER	PART NUMBER (LCI-200CE)	QUANTITY
A2	ASSY, LED IND BD 12V GREEN	H9290-3		1
A3	ASSY, LED IND BD 2V	H9290-8	H9290-9	1
*A9	ASSY LCI LIGHT CONTROLLER BD	H9518		1
**A10	SENSOR	H9513		1
*M2	MOTOR, GEARHEAD, LCI	805783-3		1
SW2	SWITCH, DPST ROCKER	H7808		1
W008	ASSY, WIRE HARNESS W008 LCI	H9282		1
W110	ASSY, WIRE HARNESS W110 MIS	H8071		1
1	FRONT PANEL, LCI-200	807493	808237	1
2	LAMP, FIBER HOLDER, LCI	807545		1
3	LAMP SPRING, LCI	H9193		1
4	BALL PLUNGER	H9212		3
5	4-40 X .250 PH FL MS ST ZN	H308		3
6	4-40 X .188 SC SE CU SS	H1040		2
7	THERMAL COMPOUND	H1563N		0
8	LOCTITE 222	M30329		0
9	#4 SPLIT MED LW ST ZN	H326		4
10	4-40 X .188 PH PN MS ST ZN	H5090		4
11	6-32 X .375 PH PN MS ST ZN	H317		2
12	#6 SPLIT MED LW ST ZN	H327		2
13	DOWEL PIN .093 X .50	H9509		1
14	2-56 X .187 PH PN SEMS-IL ST ZN	806426		4
*16	BRACKET, MOTOR	H9510		1
17	ECENTRIC	H9511		1
18	BUSHING, ECENTRIC	H9512		1
*19	LIGHT VANE LCI-200	H9527		1
20	WAVE WASHER .095 ID	H9514		1
*21	SPACER, LIGHT VANE	H9517		1
22	SOLDER SN63 WRMAP3 .022 DIA	M31441		0
23	TIE, WIRE	H1587		4
24	4-40 X .313 PH PN MS ST ZN	H312		1

NOTES:


On early models, this screw mounts item #23.



See Sensor Assembly procedure if this screw is removed.

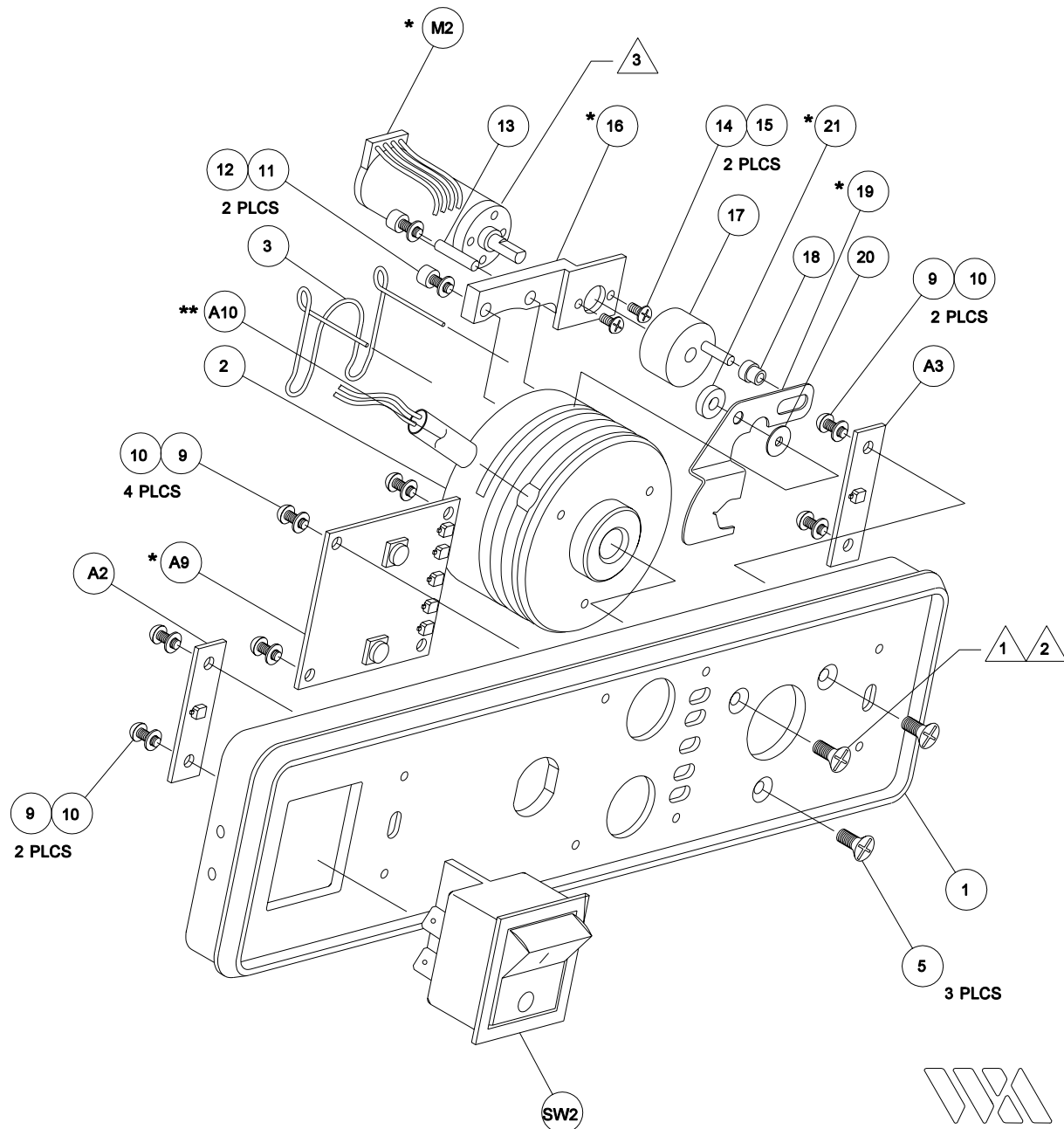


Motor is equipped with both American and Metric Standard threads. Assure American Standard threads are used to avoid stripping.

* Not in LCI-100

**** LCI-200 ONLY (Early Versions)**

FIGURE 5:



FRONT PANEL EXPLODED VIEW

Reference Drawing #807543

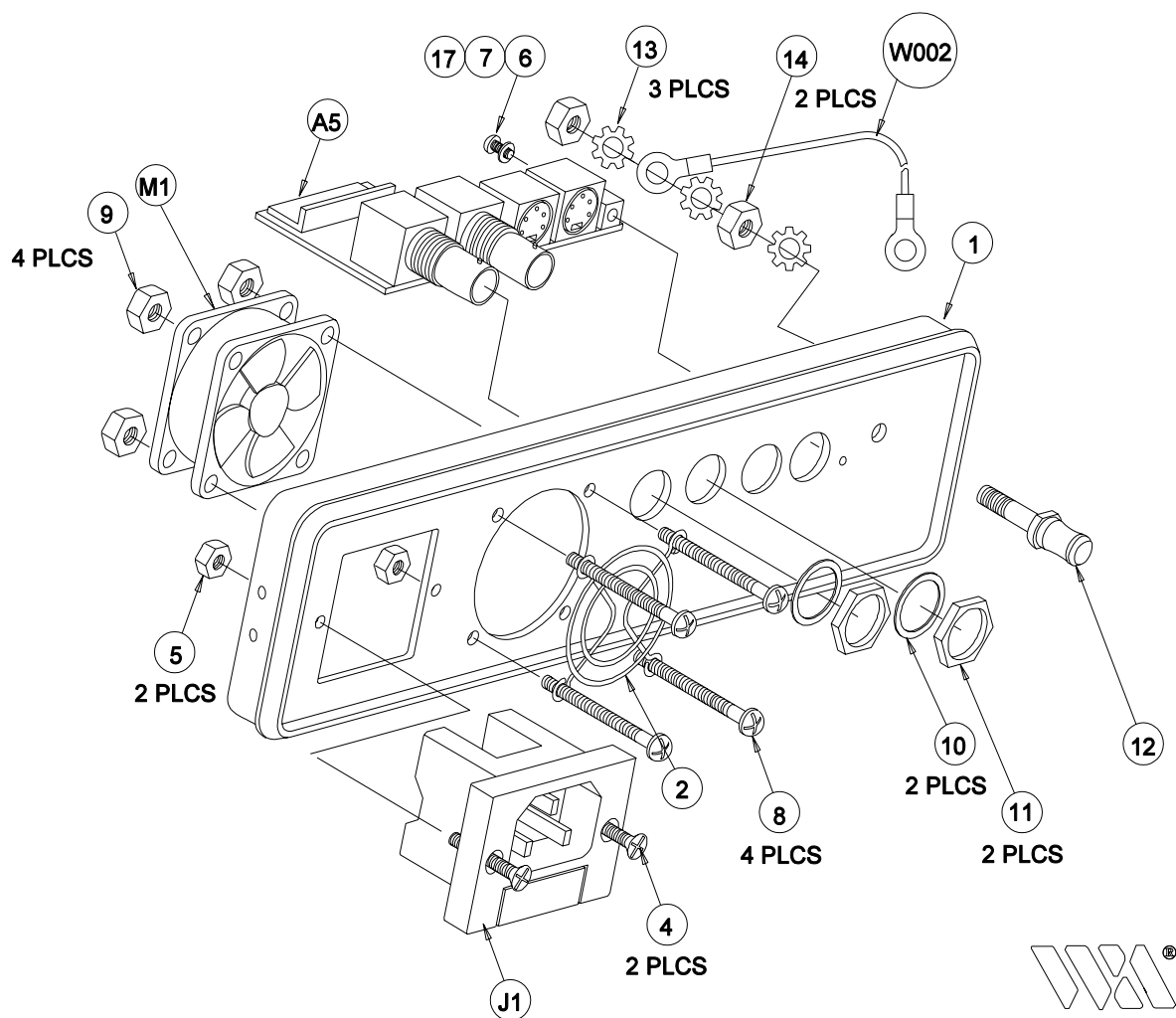
* Not in LCI-100
** LCI-200 ONLY (Early Version)

FIGURE 6: REAR PANEL PARTS LIST

BUBBLE NUMBER	DESCRIPTION	PART NUMBER	QUANTITY
A5	ASSY, LCI VIDEO OUTPUT DVR BD	H9202	1
F1	FUSE, 2.0, 250V (F1, F2)	H9213	1
F2	FUSE, 2.0, 250V (F1, F2)	H9213	1
J1	FUSE CARRIER, DBL POLE	H7677	1
M1	FAN	H9210	1
W001	ASSY WIRE, W001 MIS	H8047	1
W002	ASSY, WIRE HARNESS W002 LCI	H9286	1
1	REAR PANEL	H9191	1
2	FAN GUARD	H9211	1
3	CARRIER, FUSE	H7785	2
4	4-40 X .750 PH FL MS ST ZN	H936	2
5	4-40 SELF-LOCKING NUT	H4462	2
6	4-40 X .380 PH PN MS ST ZN	H313	1
7	#4 SPLIT MED LW ST ZN	H326	1
8	8-32 X 1.25 PH PN MS ST ZN	H9295	4
9	NUT SELF LOCKING 8-32	H4464	4
10	WASHER, LOCK	H7684	2
11	NUT, JAM	H7685	2
12	STUD, GROUND	H8963	1
13	#10 EXT LW ST ZN	H2640	3
14	10-32 HX MS NUT ST ZN	H240	2
15	CRIMP TERMINAL	H6768	2
16	.032 DIA ENERGIZED ROSIN SOLDER	M31426	0
17	GROUND STUD, LCI	H9227	1
18	WAVE WASHER #8	802258-1	4

Figure 6

Rear Panel Exploded View



Reference Drawing #806770

FIGURE 7: CHASSIS PARTS LIST

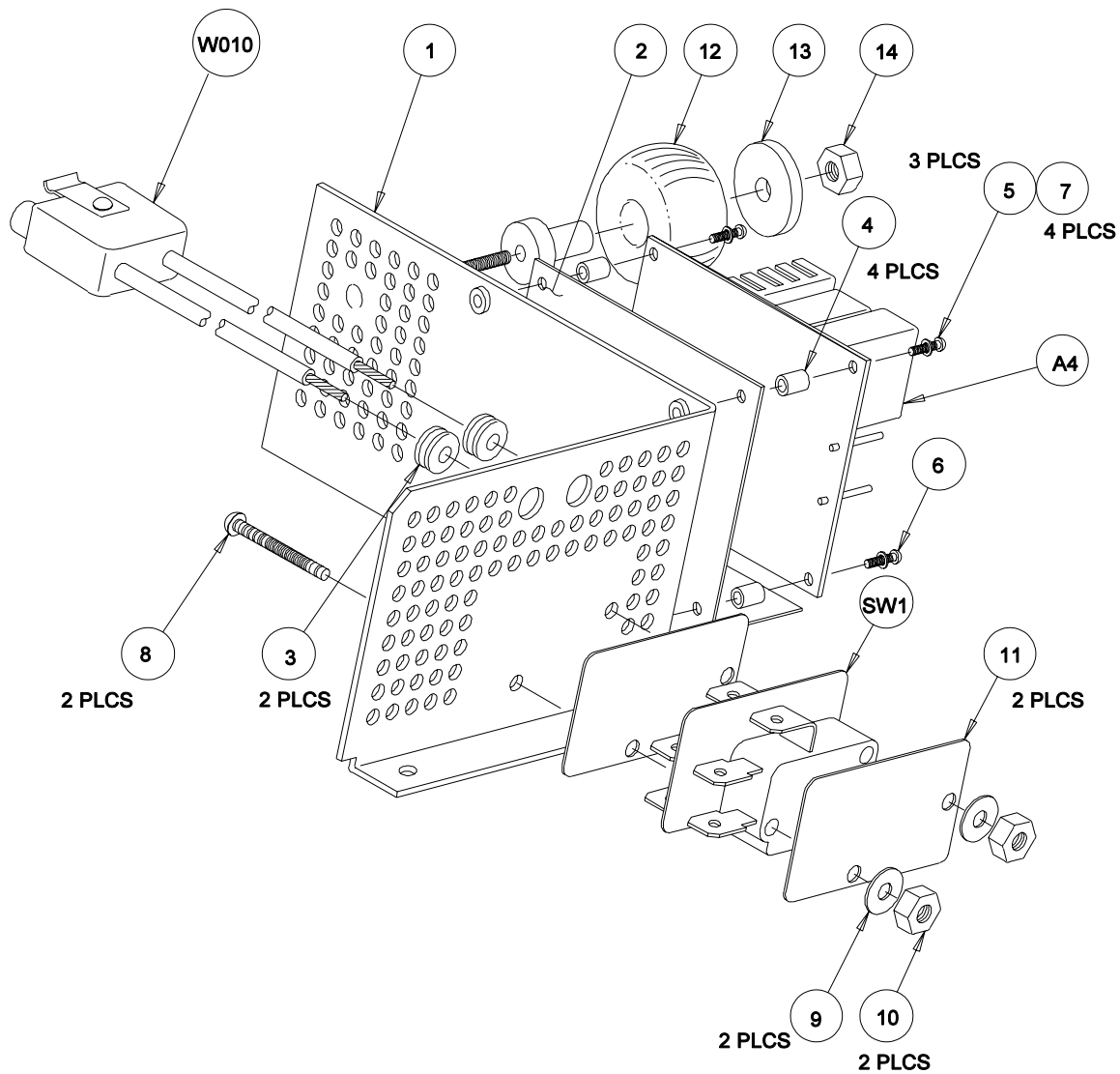
BUBBLE NUMBER	DESCRIPTION	PART NUMBER	PART NUMBER (LCI-200CE)	QTY
A1	POWER SUPPLY, CONDOR 40W	H8937		1
A8	ASSY, LAMP LCI	H9194		1
W005	ASSY, WIRE HARNESS W005 LCI	H9285		1
W006	ASSY, WIRE HARNESS	H9248		1
W009	ASSY, WIRE HARNESS W009 LCI-200	H9580		1
1	CHASSIS	H9185		1
2	TOP COVER LCI-100/200	807771	808257	1
3	LAMP DOOR, LCI	H9187		1
4	BOTTOM SHIELD, LCI	H9222		1
5	TOP SHIELD, LCI	H9223		1
6	ASSY, BALLAST LCI	H9291	808266	1
7	ASSY, FRONT PANEL LCI	807543	808263	1
8	ASSY, REAR PANEL LCI	H9293	808265	1
9	ASSY, CAMERA LCI NTSC/PAL	H9296/H929	806774-1	1
10	SHIELD, STAND OFF, LCI	H9228		4
11	BUMPER, CABINET	H614		4
12	#8 SPLIT MED LW ST ZN	H328		4
13	8-32 HX MS NUT ST ZN	H239		4
14	6-32 SELF-LOCKING NUT	H4463		1
15	4-40 SELF-LOCKING NUT	H4462		3
16	10-32 HX MS NUT ST ZN	H240		4
17	#10 EXT LW ST ZN	H2640		6
18	#6 INT LW SS	H494		8
19	#6 THRUST FW SS	H498		4
20	6-32 X .312 PH PN MS ST ZNBC	H6669		12
21	6-32 X .313 PH PN MS ST ZN	H997		4
24	TIE, WIRE	H1587		8
25	LABEL, PROTECTIVE EARTH, GRD-	H2702		1
26	LABEL, WARRANTY	H8261		2
27	LOCTITE 222	M30329		0
28	GROMMET	H9886		2

FIGURE 8: BALLAST ASSEMBLY PARTS LIST

BUBBLE NUMBER	DESCRIPTION	PART NUMBER	PART NUMBER (LCI-200CE)	QTY
A4	BALLAST, 24 WATT UNREGULATED	43204289-02		1
SW1	MICROSWITCH, DOUBLE POLE	H7676		1
W003	ASSY WIRE, W003 MIS	H8049	808267	1
W004	ASSY WIRE W004 MIS	H8050		1
W007	ASSY, WIRE HARNESS W007 LCI	H9283		1
W010	CONNECTOR ASSY, BALLAST SIDE	H8873		1
1	INNER CHASSIS, LCI	H9188		1
2	BALLAST INSULATOR, LCI	H9224		1
3	GROMMET, .126ID X .06 X .25	H7674		2
4	SPACER, 3/16 X 3/16 WHITE NYLON	807311		4
5	2-56 X .438 PH PN MS ST ZN	H4041		3
6	2-56 X .375 PH PN MS NY	807312		1
7	#2 INT LW SS	H2712		4
8	4-40 X 1.125 PH PN MS ST ZN	H2046		2
9	#4 THRUST FW SS	H497		2
10	4-40 SELF-LOCKING NUT	H4462		2
11	INSULATING PLATE	H2041		2
12	SPOOL, INDUCTOR	H8222		1
13	WASHER, INDUCTOR	H8223		1
14	6-32 SELF LOCKING NUT	H4463		1
15	TIE, WIRE	H1587		1
16	.032 DIA ENERGIZED ROSIN SOLDER	M31426		0
17	LOCTITE 222	M30329		0

Figure 8

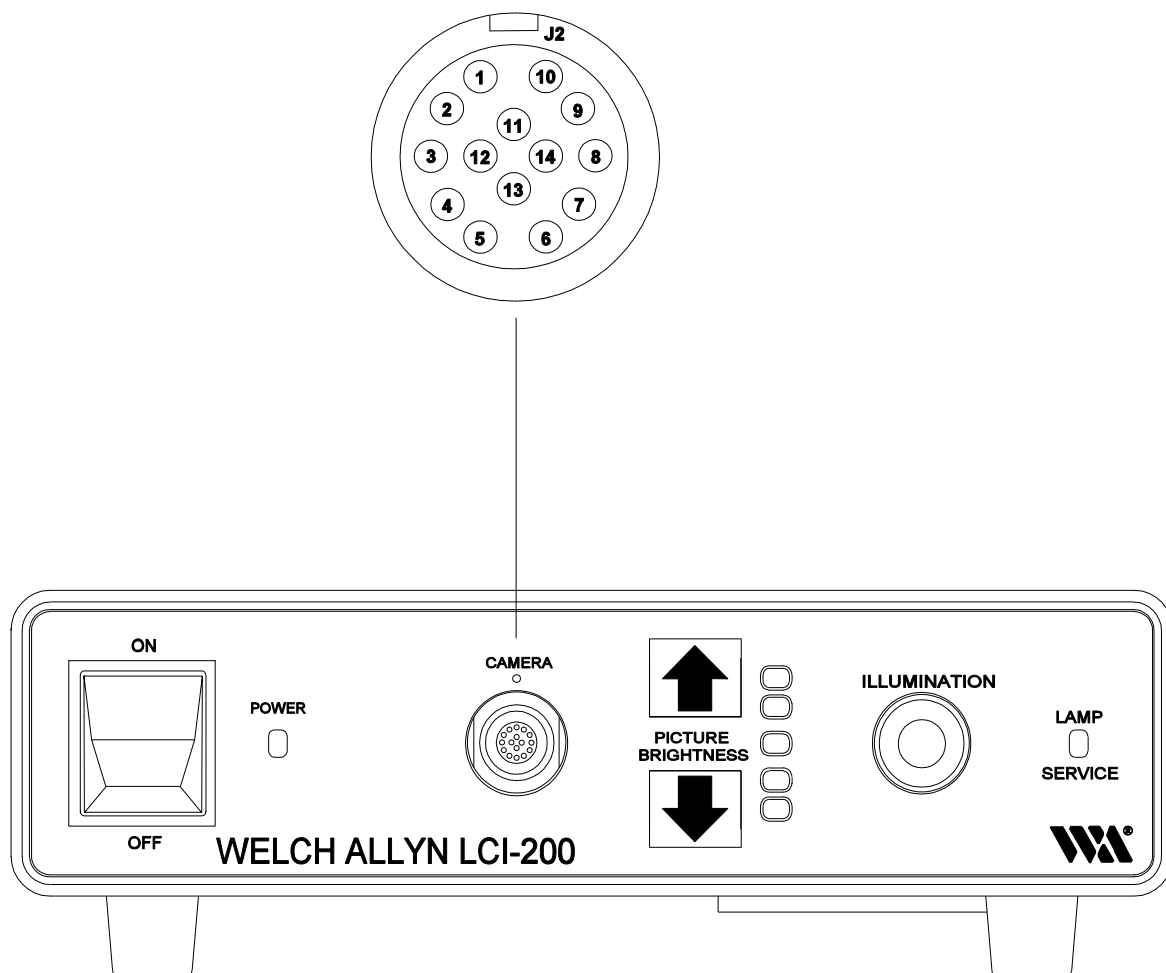
BALLAST ASSEMBLY EXPLODED VIEW



Reference Drawing #806768

Figure 9

LEMO Connector Diagram



Video Output Board Removal and Replacement

1. Remove Top Cover (Fig 7, #2) by removing 4 screws.
2. Release Rear Panel (Fig 7, #8) by removing 3 screws.
3. Tilt Rear Panel (Fig 7, #8) slightly forward.
4. Remove connector (Interconnect Diagram, P8 of W009) from Output Board (Fig 6, #A5).
5. Remove screw and lockwasher (Fig 6, #6 & 7) securing ground stud (Fig 6, #17) to Rear Panel (Fig 6, #1).
6. Remove both lockwasher and Jam Nuts (Fig 6, #10 & 11) securing Video Output Board (Fig 6, #A5) to Rear Panel (Fig 6, #1).
7. Remove Video Output Board (Fig 6, #A5).
8. Reassemble in reverse order.

Ballast Removal and Replacement

1. Remove Top Cover (Fig 7, #2) by removing 4 screws.
2. Remove Ballast Assembly (Fig 7, #6) by removing 3 self locking nuts (Fig 7, #15).
3. Remove ballast (Fig 8, #21) by removing 3 Phillips head screws (Fig 8, #13) and 1 plastic screw (Fig 8, # 19).
4. Desolder Lamp Connection Assembly (Fig 8, #8) from Ballast (Fig 8, #21).
5. Reassemble in reverse order. Be sure plastic screw (Fig 8, #19), plastic standoffs (Fig 8, #11), and Ballast Insulator (Fig 8, #18) are replaced in their original positions.

Power Supply Removal and Replacement

1. Remove Top Cover (Fig 7, #2) by removing 4 screws.
2. Remove Top Shield (Fig 7, #5) by removing 4 screws (Fig 7, #21).
3. Disconnect Connector (Interconnect Diagram, P1 of W005) from Power Supply (Fig 7, #A1).
4. Disconnect Ground Wire (Interconnect Diagram, W006).
5. Disconnect wire harness (Interconnect Diagram, P2 of W007).
6. Remove 4 standoffs (Fig 7, #10).
7. Remove and replace Power Supply (Fig 7, #A1).
8. Reassemble in reverse order.

Refer to Interconnect Diagram in Schematic Section for wire harness designations.

Front Panel Removal

1. Remove Top Cover (Fig 7, #2) by removing 4 screws.
2. Remove LEMO Nut portion of Camera Assembly, (Fig 7, #9) from Front Panel (Fig 7, # 7) using Welch Allyn LEMO Removal Tool (WT-1962).
3. Remove 3 screws (Fig 7, #20) securing Front Panel to Chassis, and tilt Front Panel slightly (approximately 45 degrees).

Remove and Replace Camera Assembly

1. Remove Front Panel.
2. Remove 2 screws (Fig 7, #20), from bottom of Chassis, securing Camera Assembly (Fig 7, #9) to Chassis (Fig 7, #1).
3. Remove self-locking nut (Fig 7, #14) securing camera to Chassis (Fig 7, #1).
4. Disconnect Video Harness (Interconnect Diagram, P2 of W009) from Camera Assembly (Fig 7, #9) by releasing outer locking ring of connector and pulling free.
5. Remove Wire Harness (Interconnect Diagram, P3 of W009) from Front Panel Board (part of Camera Assembly Fig 7, #9).
6. Reassemble in reverse order.

***Gear Head Motor Replacement**

1. Remove top cover (Fig 7, #2). **Removal of Front Panel Not Required for Motor Replacement.**
2. Remove 2 screws (Fig 5, #11) securing Motor Bracket (Fig 5, #16) to Lamp / Fiber Holder (Fig 5, #2).

NOTE: After this step, maintain unit in level position to assure that Dowel Pin (Fig 5, #13) does not fall out of Lamp / Fiber Holder.

3. Loosen set screw securing eccentric (Fig 5, #17) to shaft of gear head motor (Fig 5, #M2), and remove eccentric and eccentric bushing (Fig 5, #18) from the light vane (Fig 5, #19).
4. Free motor from bracket by removing 2 Phillips head screws (Fig 5, #15).
5. Note color code of wires, then desolder and remove motor.
6. Remove in reverse order, but note, when reassembling 2 screws (Fig 5, #15 to motor (Fig 5, #M2), align with American Standard threaded holes. Motor is equipped with both American and Metric Standard threads.

***LED Indicator Boards and Light Controller Board**

1. Remove Front Panel (Fig 5, #1)
2. Remove LED indicator Boards and Light Controller Boards (Fig 5, #A3, A2, and #A9) and replace as necessary.

***Sensor Adjustment**

1. Remove Top Cover (Fig 7, #4)
2. Carefully peel back Front Label to expose 3 screws (Fig 5, #5).
NOTE: If this step is done carefully, the Front Label will not need to be replaced.
3. Loosen screw (Fig 5, #5) securing sensor (Fig 5, #A10).
4. Adjust position of sensor in or out until proper alignment and function is achieved.
5. Tighten set screw while maintaining position and verify alignment is still functional.
6. Repeat as necessary.
7. Reassemble in reverse order.

***Sensor Replacement**

1. Remove Top Cover (Fig 7, #2).
2. Carefully peel back Front Label to expose 3 screws (Fig 5, #5).
NOTE: If this step is done carefully, the Front Label will not need to be replaced.
3. Remove screws (Fig 5, #5) securing Lamp Fiber Holder (Fig 5, #2) to Front Panel (Fig 5, #1).
4. Carefully separate Lamp Fiber Holder (Fig 5, #2) from Front Panel (Fig 5, #1), noting position of wire harnesses for reassembly purposes.
5. Separate sensor (Fig 5, #A10) from Lamp Fiber Holder (Fig 5, #2).
6. Disconnect sensor (Fig 5, #A10) from Light Control Board (Fig 5,

#A9).

7. Replace and reassemble in reverse order noting position of wire harnesses through Lamp Fiber Holder (Fig 5, #2) to avoid pinching wires.

NOTE: On some older versions, optimum sensor positioning and adjustments may be difficult. If necessary, adjust position of wave washer (Fig 5, #20) as shown in Figure 5. This change will allow the adjustments to be made more easily.

NOTE: Sensor adjustment and replacement requires precision positioning. If assistance is needed, please call Welch Allyn.

Serial Number Label Replacement

NOTE: Refer to APPENDIX B: Camera Head Assembly Diagram for this procedure.

1. Remove damaged label (#21) from Camera head collar (#9) and set aside for later reference.
2. Thoroughly clean collar (#9) with isopropyl alcohol to remove all traces of old adhesive.
3. Obtain blank serial number label (Welch Allyn part number H9570) and stamp duplicate part number with .125 inch (3.18mm) high digits as shown.
4. Roll serial number label around a .5 inch (12.7mm) diameter rod with special care to be taken while forming the ends of the label (pre-form for better adhesion of the label ends).
5. Peel backing off label and apply to collar (#9), oriented to read from the direction shown.
6. Apply three wire ties (#36) tightly around the circumference of the label to hold ends firmly to the collar.
7. Allow the assembly to cure for a minimum of 1 hour at 100 degrees F (38 degrees C).
8. Remove wire ties using caution to avoid damaging label surface.

Soaking Cap Tether Cord Replacement

NOTE: Refer to APPENDIX B: Camera Head Assembly Diagram for this procedure.

1. Remove damaged cord (#17) by cutting off flush with edge of soaking cap (#16) and/or strain relief nut (#14) with a sharp knife.
2. Drill out remaining cord material (#17) to .135" (3.43mm) maximum in both holes with a #43 (.0890"/2.26mm) drill bit. **USE CAUTION NOT TO DRILL THROUGH INTO THE ALUMINUM BODY.**
3. Run in a 4 - 40 UNC tap approximately .13" (3.3mm) deep into both holes to reform the threads.
4. Clean threaded holes thoroughly with isopropyl alcohol and cotton swab.
5. Obtain cord (#17) and cut to 8" (203mm) length.
6. Rough-up both ends of cord (#17) with an emery board to approximately .100" (2.54mm).
7. Mix a 14 gram batch of black masterbond epoxy (#19):
 - a. Measure by weight 10.0+/-0.2 grams of part A and 4.0+/-0.2 grams of part B into same clean, plain paper cup.
 - b. Thoroughly mix part A and part B using a clean, plain wooden stirrer for a minimum of 2 minutes until a consistent color is achieved.

USE CAUTION WHEN MIXING TO AVOID INTRODUCTION OF AIR BUBBLES INTO MIXTURE.

8. Apply a drop of epoxy into each hole with a tooth pick.
9. Twist the cord into each threaded hole until it bottoms.
10. Wipe any excess epoxy (#19) from around the cord, forming a smooth fillet.
11. Allow the assembly to cure for a minimum of 1 hour at 100 degrees F (39 degrees C).

Maintenance

Preventative Maintenance

The purpose of preventative maintenance is to pro-actively reduce or eliminate future problems. Keeping the LCI-100/200 in good operating condition ensures that it will perform reliably and safely. Every six to twelve months, you should:

- Check the Fiber Optic Bundle for wear

- Check all Video and Power Cables for wear

- Check the CCD cable for signs of wear

- Ensure that, during use, the LCI-100/200 receives adequate ventilation

Additional recommendations can be found in your LCI-100/200 Operating Manual.

Visual Inspection

Check for anything out of the ordinary in all of the components of the LCI-100/200. For instance, are any of the video or power cables showing signs of age (cracking or fraying)? Are there broken fibers in the Fiber Optic Bundle? (see section on Performance Checks) Does the LCI-100/200 make too much noise? Are there any loose parts inside the Power Box? Are there any signs of leaking in or around the Camera Head?

Cleaning

The Front Panel LCI-100/200 Power box should be cleaned routinely with a damp cloth, as described in the LCI-100/200 Operating Manual. Users should also routinely inspect the exhaust fan on the back panel of the unit, as well as the exhaust holes on the Bottom Chassis, to make sure that air is able to flow freely through the LCI-100/200. Any debris around the exhaust fan or ventilation holes should be removed.

The interfaces of the Fiber Optic Bundle should also be cleaned routinely.

Check Ground Impedance

1. Disconnect the power cord from the LCI-100 Power Box.
2. Connect an ohmmeter (measuring at milli-ohms) between ground terminal of the appliance inlet receptacle and the following test points: (1) Equipment ground stud on rear panel, and (2) Camera Head threads.
3. Ensure that the ground impedance is less than 0.1 ohms.

Measuring LCI-100/200 Leakage Current

To check the LCI-100/200 Chassis Leakage Current:

1. Connect the LCI to a leakage tester, and measure leakage current on leakage meter. Ensure that leakage is less than 100 microamperes.
2. Open ground line, and ensure leakage current is less than 100 microamperes.
3. Reverse line polarity, and ensure that leakage current is less than 100 microamperes.
4. With reversed polarity, open ground line and ensure leakage is less than 100 microamperes.

Always use a high quality meter capable of testing to AAMI specifications.



CAUTION: The meter must be suitably insulated and capable of withstanding the power line voltage.

Measuring LCI-100/200 Leakage Current with Multiple Accessories

Generally, leakage current for the LCI-100/200 can be measured independently. However, when the LCI-100/200 camera system is used in conjunction with other video accessories (such as printers and VCRs), it may be necessary to measure the leakage current of the entire set up. A typical multiple component setup is shown below.

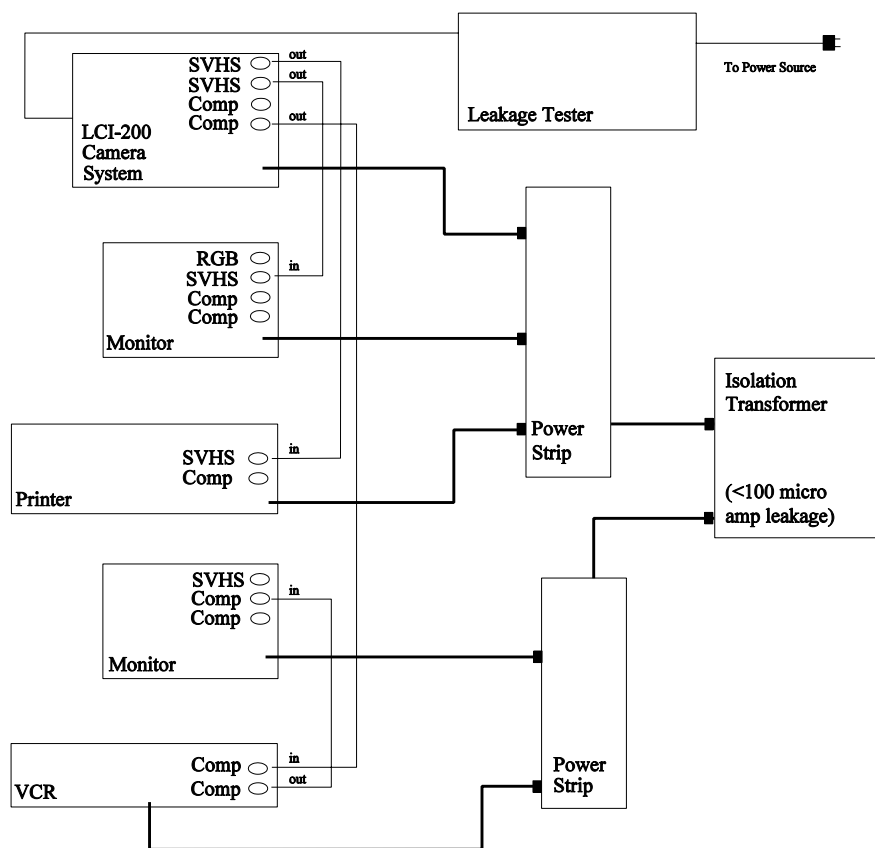


Figure 10: Diagram illustrating typical leakage current test setup, when the LCI-100/200 is used with multiple accessories.

An isolation transformer must be used if the leakage current exceeds 100 microamperes, in order to conform with UL-544 standards. The maximum allowable leakage current of the patient applied part (Type F Endoscope) is 10 microamperes.

Theory of Operations

Introduction

The LCI-100/200 integrates light source, camera processor, and light control in a single system. This system is controlled by the following major subcomponents: Power Supply; SONY Camera Processor; Front Panel Board; Light Control Board, and Ballast. this section describes these boards. Refer to Figure 2 on page 7 for the Functional Block Diagram, illustrating each of these boards.

Start Up Routine

Upon turning the Power switch on the "ON" position, the lamp ignites with a flash, and warms up for approximately 5 seconds. During this time, the color of the light emitted by the lamp will vary. The Power LED will immediately illuminate. The Picture Brightness LEDs (all five) turn on for 1 second, and then only the center LED is illuminated. The Picture Brightness controls are active once the center LED is illuminated. A video picture is produced approximately one second after the Power is turned "ON". The light control motor travels back and forth to find its proper position during and after lamp warm up.

Power Supply

UNIVERSAL INPUT, SWITCHING AC TO DC MEDICAL GRADE POWER SUPPLY

The power supply accepts an input voltage of 100-240 VAC, single phase. The primary circuit provides adequate control of leakage current, which is limited to 35 microamperes maximum. the primary side of the power supply rectifies the AC voltage and converts it to a high voltage DC level. This DC voltage is connected to the isolation transformer through a switching device, typically a MOSFET. The MOSFET is triggered by a high frequency clock circuit, typically at a 30-50 kilohertz rate. The secondary side of this transformer provides isolation between primary and secondary circuits. The secondary voltage is rectified and filtered to provide a +15V DC output voltage at 2.7 amps. the output voltage is regulated to 2%, with a peak-to-peak noise of 150 mV. The output is fully protected against short circuit and output overload. Short circuit protection is a cycling type power limit with automatic recovery after fault.

*Light Control Board

The LCI light controller senses video intensity levels and automatically adjusts light output level by moving a mechanical motor driven shutter (light vane).

Circuit Description:

Microcontroller U1 is the heart of the circuit controlling U2, which is a stepper motor driver that generates four stepper phases.

On power up, a clock signal from pin 24 of U1 is an output to pin 7 of U2 along with a direction signal from pin 23 of U1 to pin 10 of U2. U2 is a stepper motor driver which generates the four stepper phases at pins 3, 15, 14 of U2 which connect to J2. A stepper motor with an aperture vane connected to J2 moves to calibrate itself. After power up calibration the other functions of the circuit are enabled.

A video signal is input through pin 5 of J1. The signal is buffered and detected by the circuit consisting of Q2, U3, Q1 producing a fluctuating DC signal which is input to pin 16 of U1. The software interprets this signal and sends clocking signals to U2 to turn the aperture vane attached to the stepper motor for an increase or decrease of light output.

The user can adjust the software threshold setting for five different levels. This is accomplished by switches S1 (up) and S2 (down). LEDs D1-D5 provide an indication for the level selected. When LED D1 is illuminated, the stepper motor opens the aperture blade for maximum light output. The motor will not move when this position is selected.

A photo sensor verifying the presence of a fiber bundle is connected to J3. When the bundle is present, +4.5V +/-0.5V. (note: if this voltage is higher, then the aperture blade can oscillate).

Power section:

J1 pins 1 & 3 supply +12V to the board. Regulator U6 converts +12V to +7.4V. Regulator U5 converts +7.4V to +5V. U4 monitors the reset line of the microcontroller. The voltage at pin 1 of U1 should be low at initial power up, then snap to +5V and stay at +5V during operation.

Video Output Board

The video output driver board provides composite and Y/C (SVHS) video signals to drive external video devices (monitors, recorders, etc.).

Circuit Description:

The Y (luminance) signal from the camera is input via J8-pin 11 to pin 3 of video op amp U8. The output (pin 6) of U8 is an amplified Y signal with a gain of two. The C (chroma) signal from the camera is input via J8-pin 13 to pin 3 of video op amp U7. Output (pin 6) of U7 is the amplified C signal with a gain of two. Amplified Y/C signals are output to connectors J4 and J5 which allows two independent Y/C (SAHS) video devices to be driven. The amplified Y/C signals are also summed and input to pin 3 of U9 (note: the summing divides the signal levels by two). Output (pin 6) of U9 is an amplified composite video signal of 2 V p-p. which is fed to BNC connectors J6 and J7. A separate 75 ohm composite video device can be driven from each connector (J6, J7). Note: When a 75 ohm device is connected the measured video signal at the connector output is 1V p-p.

Power section:

+15V is input via J8 (pin 1). Voltage regulator U6 converts +15V (pin 3) to +12V (pin 2). Voltage regulator U5 generates -12V (pin 11) from +15V (pin 14). These two voltages (+12V, -12V) supply power to op amps U7, U8, U9 and pin 7 and pin 4 respectively. +12V is also output to pins 3, 5, 7, 9 of J8 for use by other circuit boards.

Camera Module Assembly

The Camera Module contains the electric circuitry that generates the signals necessary to drive the CCD imager. It also processes the video signals produced by the CCD into S-Video Y and S-Video C signals. These signals are supplied to the Video Output Board.

The Camera Module is supplied with +12V DC and ground through the I/O connector at the rear of the module. The +12V is converted by an internal switching power supply to the regulated power supply voltages required by the internal camera circuitry. The internal circuit boards contain the following basic circuits:

- SYNC signal generation
- Timing and imager clock signal generation
- Imager clock driver circuitry
- CCD signal processing circuitry
- Color video encoding circuitry
- CCD electronic iris control circuitry
- Camera white balance adjustment circuitry

The Camera Module supplies the Front Panel Board with clock and power supply signals and high frequency clock driver circuits required by the CCD. A flex circuit, located between the Camera Module and the Front Panel Board connects these two components.

The camera module supplies the Video Output Board at the rear of the Power Box with S-video-Y and S-video-C signals, which it buffers and supplies to the output connectors as video signals.

The only adjustments that are made to the Camera Module are the manual white adjustments. The RED and BLUE manual white balance controls are located through a small slot in the top side of the module. These controls are factory adjusted with a vectorscope, using white test pattern to null the color output of white.

There are several dip switches also located on the Camera Module. The position of these switches should never be changed, since these switches determine key parameters in the video processing of the image. The switches should always be positioned as diagrammed in Camera Module Board Diagram in Appendix A..

Front Panel (Delay Line) Board

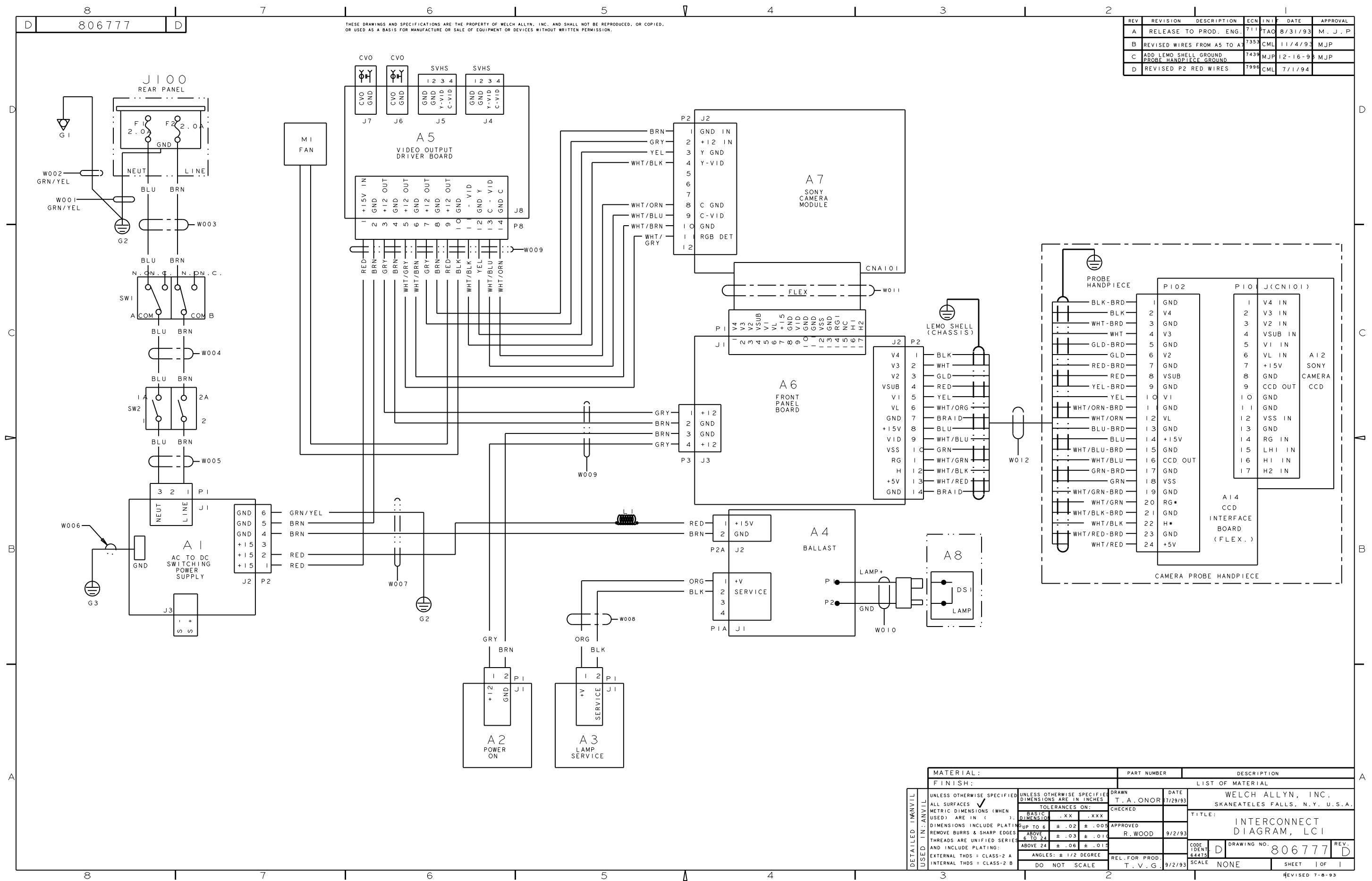
The Front Panel board provides the interface between the camera processor and the detached CCD head. This circuit is proprietary and can not be serviced in the field.

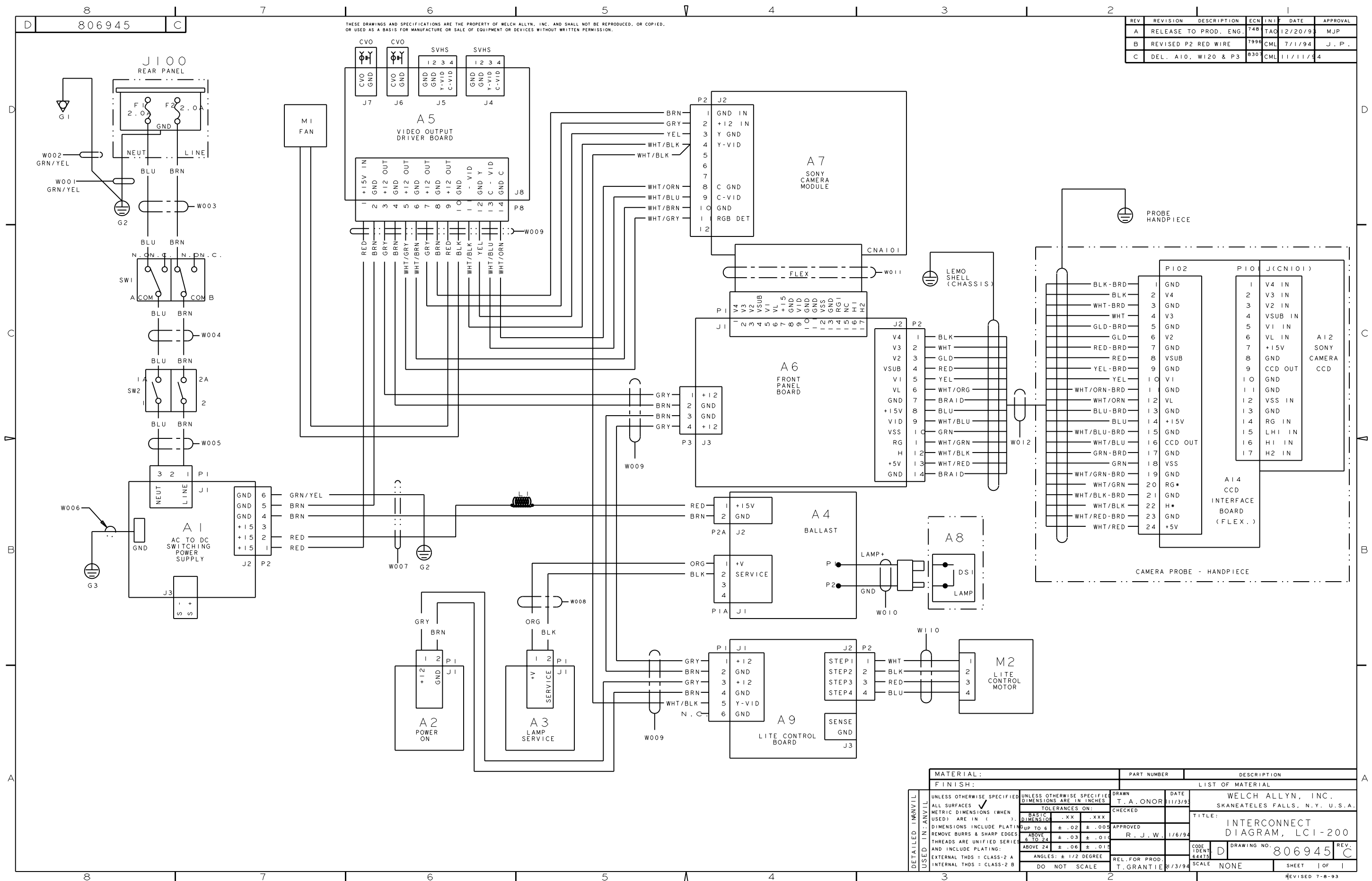
Ballast Board

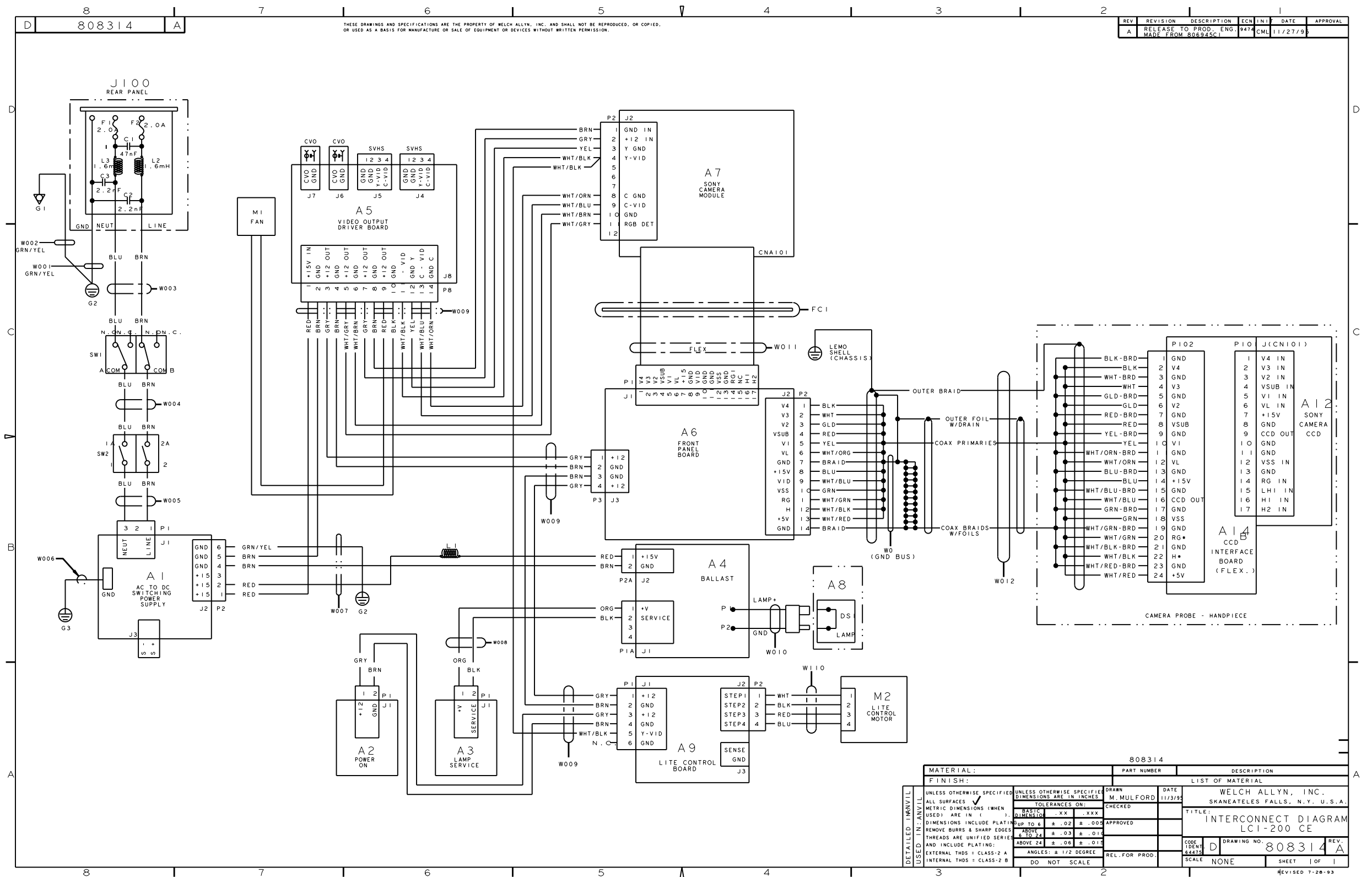
The ballast board is a power supply used to operate the 24 watt Welch Allyn miniature arc lamp. The nature of arc lamps require a ballast which limits the current, and therefore the power, in the lamp. There are three states of the operation of the ballast: ignition, warm up, and steady state. In ignition, the ballast provides the lamp with a train of ignition pulses of between 6kV and 7kV. Once the lamp is ignited, the ballast conducts current at a very low impedance, which constitutes the warm up phase. Once it warms up, the impedance changes to a higher steady state value.

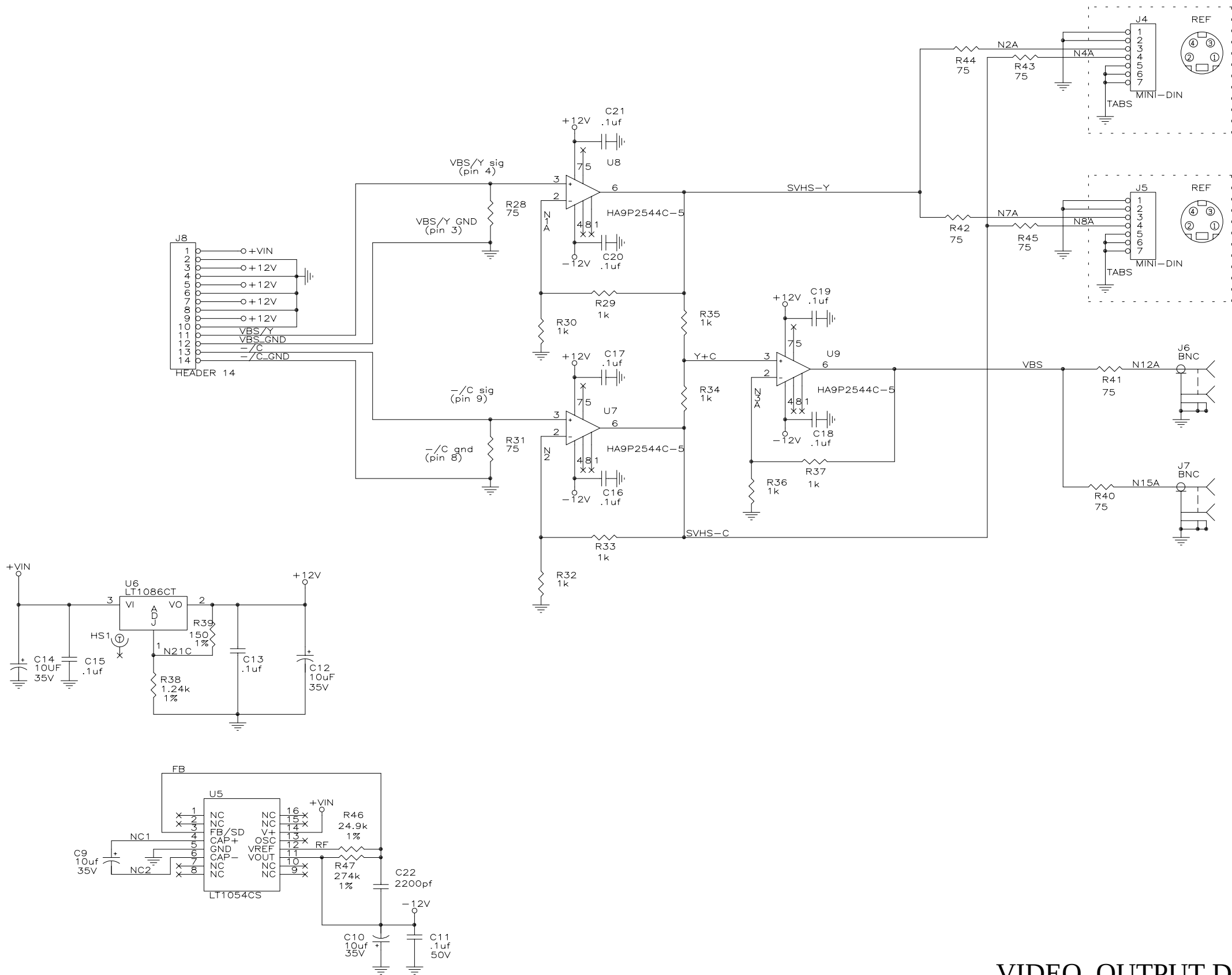
Like the Video Input Driver Board, the Ballast Board is proprietary and not field serviceable.

APPENDIX A





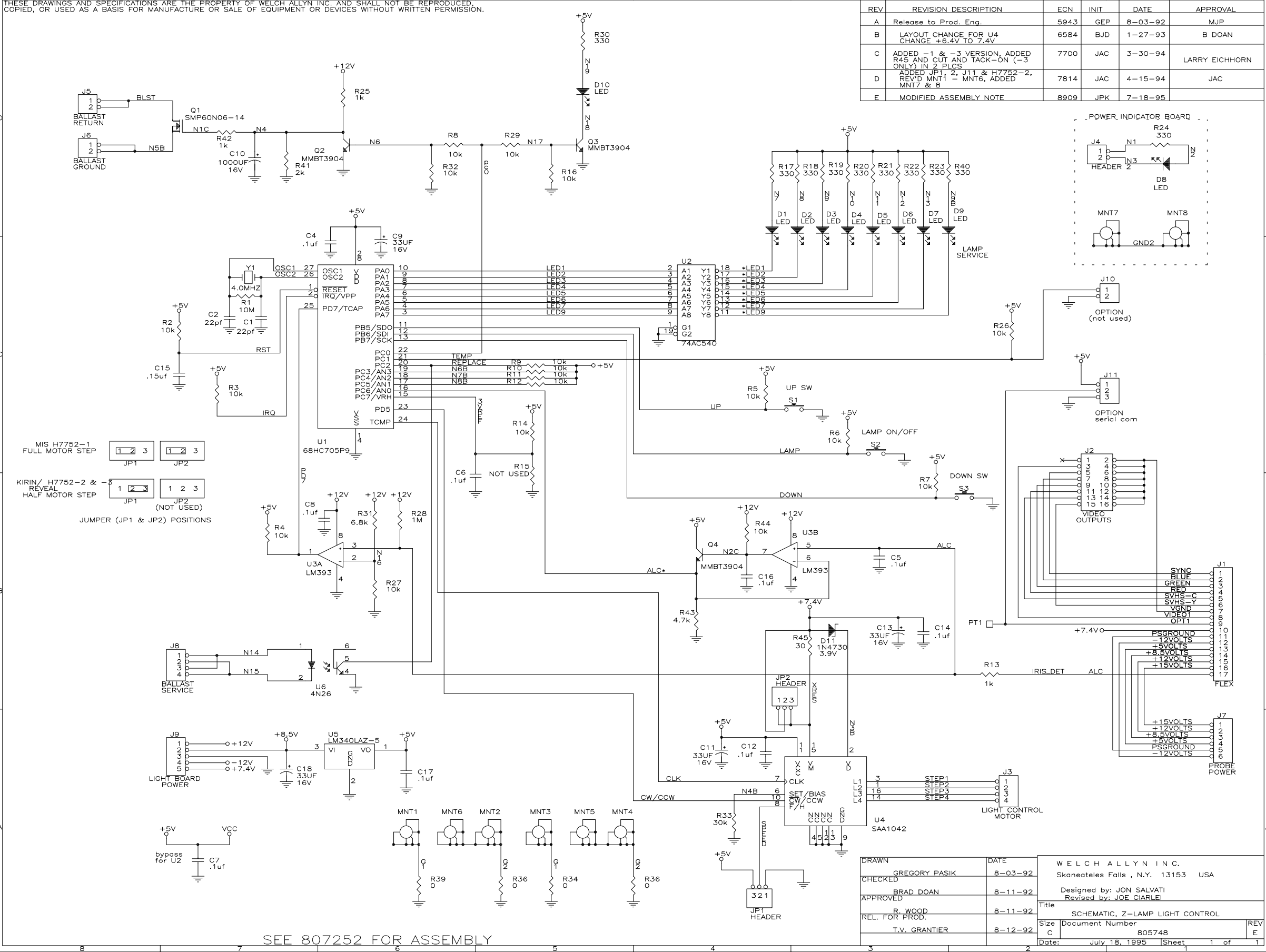




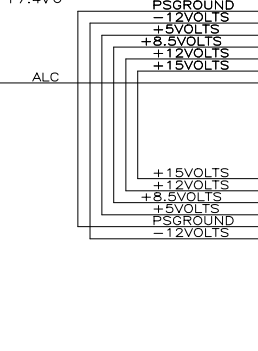
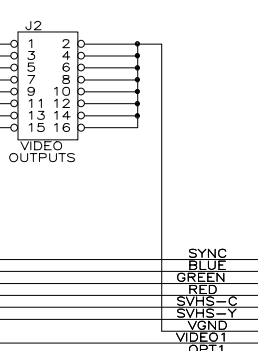
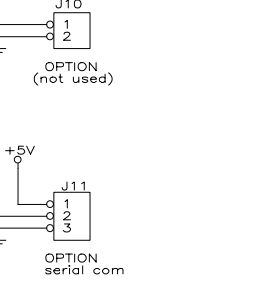
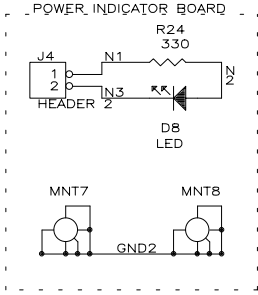
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VIDEO OUTPUT DRIVER BOARD

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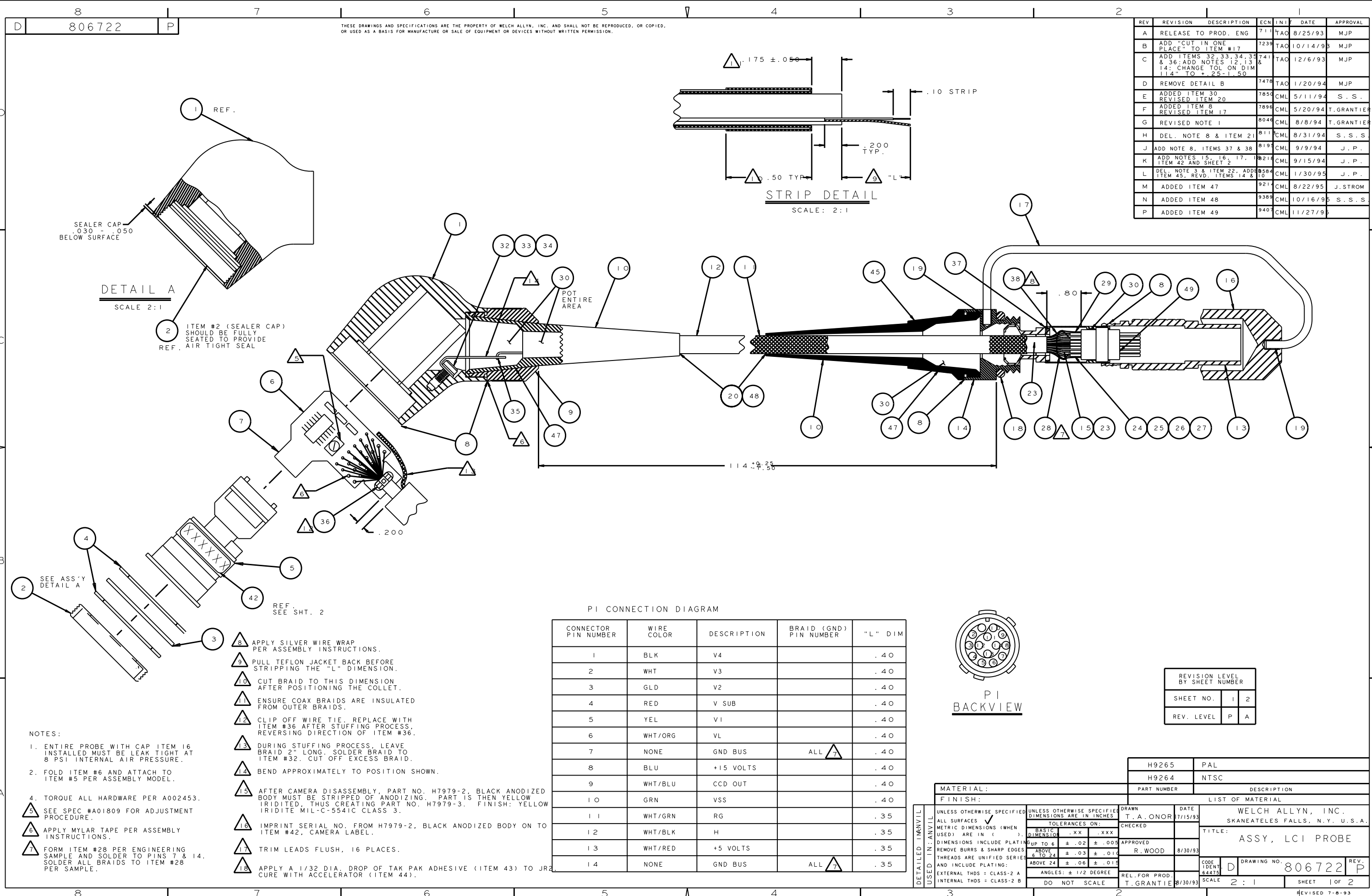
REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	Release to Prod. Eng.	5943	GEP	8-03-92	MJP
B	LAYOUT CHANGE FOR U4 CHANGE +6.4V TO 7.4V	6584	BJD	1-27-93	B DOAN
C	ADDED -1 & -3 VERSION, ADDED R45 AND CUT AND TACK-ON (-3 ONLY) IN 2 PLCS	7700	JAC	3-30-94	LARRY EICHORN
D	ADDED JP1, 2, J11 & H7752-2, REV'D MNT1 - MNT6, ADDED MNT7 & 8	7814	JAC	4-15-94	JAC
E	MODIFIED ASSEMBLY NOTE	8909	JPK	7-18-95	



DRAWN	GREGORY PASIK	DATE	8-03-92	WELCH ALLYN INC. Skaneateles Falls, N.Y. 13153 USA Designed by: JON SALVATI Revised by: JOE CIARLEI Title SCHEMATIC, Z-LAMP LIGHT CONTROL Size C Document Number 805748 REV E
CHECKED	BRAD DOAN	DATE	8-11-92	
APPROVED	R. WOOD	DATE	8-11-92	
REL. FOR PROD.	T.V. GRANTIER	DATE	8-12-92	
		DATE	July 18, 1995	

SEE 807252 FOR ASSEMBLY

APPENDIX B



SEALER CAP
.030 - .050
BELOW SURFACE

DETAIL A
SCALE 2:1

ITEM #2 (SEALER CAP)
SHOULD BE FULLY
SEATED TO PROVIDE
REF. AIR TIGHT SEAL

SEE ASS'Y
DETAIL A

REF.
SEE SHT. 2

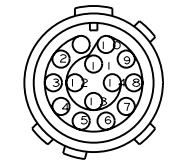
- NOTES:
- ENTIRE PROBE WITH CAP ITEM 16 INSTALLED MUST BE LEAK TIGHT AT 8 PSI INTERNAL AIR PRESSURE.
 - FOLD ITEM #6 AND ATTACH TO ITEM #5 PER ASSEMBLY MODEL.

- TORQUE ALL HARDWARE PER A002453.
- SEE SPEC #A01809 FOR ADJUSTMENT PROCEDURE.
- APPLY MYLAR TAPE PER ASSEMBLY INSTRUCTIONS.
- FORM ITEM #28 PER ENGINEERING SAMPLE AND SOLDER TO PINS 7 & 14. SOLDER ALL BRAIDS TO ITEM #28 PER SAMPLE.

- APPLY SILVER WIRE WRAP PER ASSEMBLY INSTRUCTIONS.
- PULL TEFLON JACKET BACK BEFORE STRIPPING THE "L" DIMENSION.
- CUT BRAID TO THIS DIMENSION AFTER POSITIONING THE COLLET.
- ENSURE COAX BRAIDS ARE INSULATED FROM OUTER BRAIDS.
- CLIP OFF WIRE TIE. REPLACE WITH ITEM #36 AFTER STUFFING PROCESS. REVERSING DIRECTION OF ITEM #36.
- DURING STUFFING PROCESS, LEAVE BRAID 2" LONG. SOLDER BRAID TO ITEM #32. CUT OFF EXCESS BRAID.
- BEND APPROXIMATELY TO POSITION SHOWN.
- AFTER CAMERA DISASSEMBLY, PART NO. H7979-2, BLACK ANODIZED BODY MUST BE STRIPPED OF ANODIZING. PART IS THEN YELLOW IRIDITED, THUS CREATING PART NO. H7979-3. FINISH: YELLOW IRIDITE MIL-C-5541C CLASS 3.
- IMPRINT SERIAL NO. FROM H7979-2, BLACK ANODIZED BODY ON TO ITEM #42, CAMERA LABEL.
- TRIM LEADS FLUSH, 16 PLACES.
- APPLY A 1/32 DIA. DROP OF TAK PAK ADHESIVE (ITEM 43) TO JR2. CURE WITH ACCELERATOR (ITEM 44).

PI CONNECTION DIAGRAM

CONNECTOR PIN NUMBER	WIRE COLOR	DESCRIPTION	BRAID (GND) PIN NUMBER	"L" DIM
1	BLK	V4		.40
2	WHT	V3		.40
3	GLD	V2		.40
4	RED	V SUB		.40
5	YEL	V1		.40
6	WHT/ORG	VL		.40
7	NONE	GND BUS	ALL 7	.40
8	BLU	+15 VOLTS		.40
9	WHT/BLU	CCD OUT		.40
10	GRN	VSS		.40
11	WHT/GRN	RG		.35
12	WHT/BLK	H		.35
13	WHT/RED	+5 VOLTS		.35
14	NONE	GND BUS	ALL 7	.35



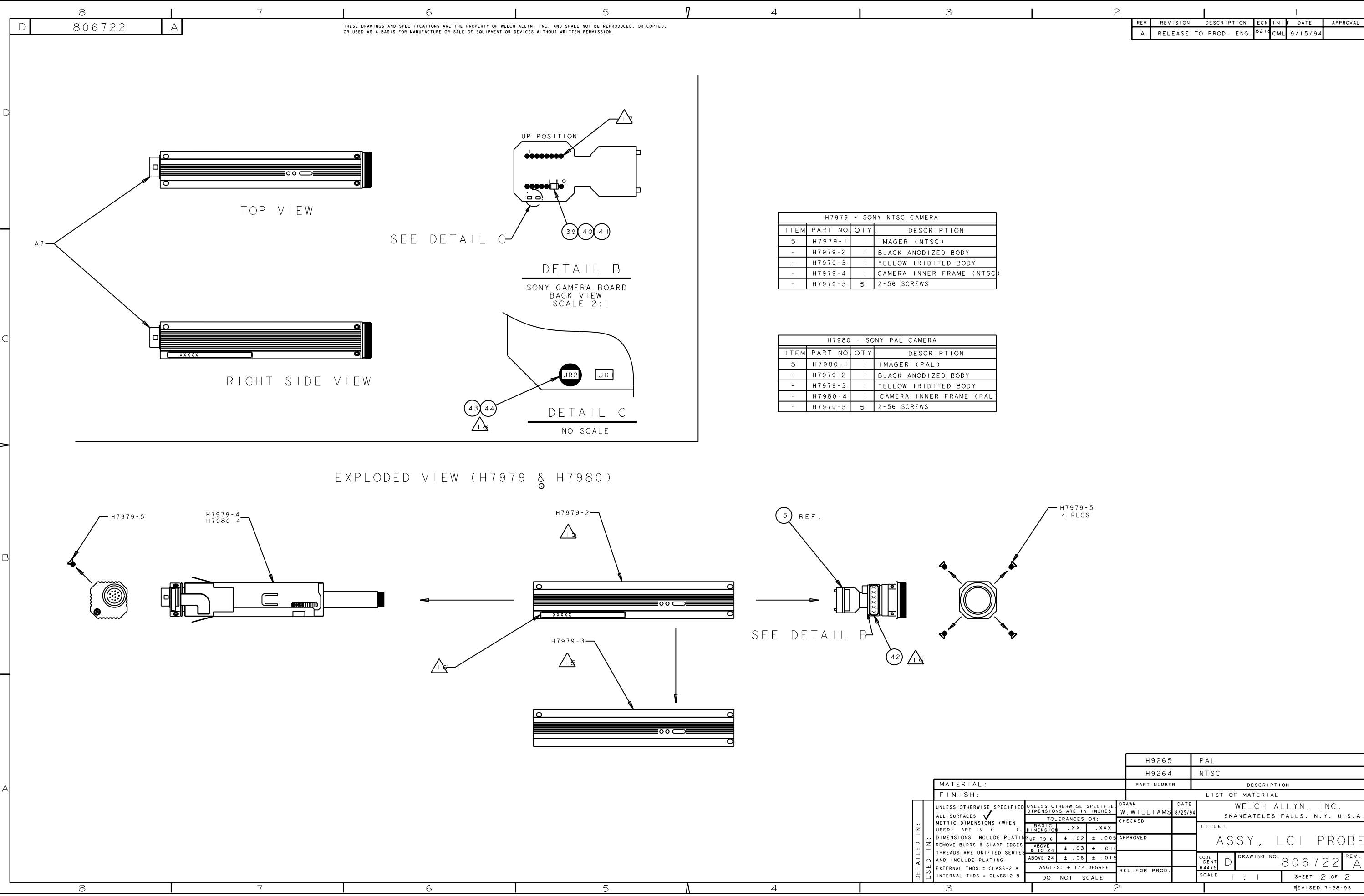
PI
BACKVIEW

REVISION LEVEL BY SHEET NUMBER		
SHEET NO.	1	2
REV. LEVEL	P	A

H9265		PAL
H9264		NTSC
PART NUMBER		DESCRIPTION
MATERIAL:		LIST OF MATERIAL
FINISH:		WELCH ALLYN, INC. SKANEATELES FALLS, N.Y. U.S.A.
DRAWN T.A.ONOR		DATE 7/15/93
CHECKED		APPROVED R.WOOD 8/30/93
REL. FOR PROD. T.GRANTIE		DATE 8/30/93
DO NOT SCALE		SCALE 2:1
SHEET 1 OF 2		REV. P

REV	REVISION	DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PROD. ENG		711	TAO	8/25/93	MJP
B	ADD "CUT IN ONE PLACE" TO ITEM #17		7239	TAO	10/14/93	MJP
C	ADD ITEMS 32, 33, 34, 35 & 36; ADD NOTES 12, 13 & 14; CHANGE TOL ON DIM 114" TO +.25-1.50		741	TAO	12/6/93	MJP
D	REMOVE DETAIL B		7478	TAO	1/20/94	MJP
E	ADDED ITEM 30 REVISED ITEM 20		7850	CML	5/11/94	S.S.
F	ADDED ITEM 8 REVISED ITEM 17		7896	CML	5/20/94	T.GRANTIE
G	REVISED NOTE 1		8046	CML	8/8/94	T.GRANTIE
H	DEL. NOTE 8 & ITEM 21		8118	CML	8/31/94	S.S.
J	ADD NOTE 8, ITEMS 37 & 38		8193	CML	9/9/94	J.P.
K	ADD NOTES 15, 16, 17, 18 ITEM 42 AND SHEET 2		8216	CML	9/15/94	J.P.
L	DEL. NOTE 3 & ITEM 22, ADD ITEM 45, REV. ITEMS 14 & 10		8584	CML	1/30/95	J.P.
M	ADDED ITEM 47		9214	CML	8/22/95	J.STROM
N	ADDED ITEM 48		9389	CML	10/16/95	S.S.
P	ADDED ITEM 49		9407	CML	11/27/95	

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Welch Allyn LCI-100/200 Service Manual
Part Number VA316, Rev. D

